GHOST MOTHS

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EXCURSIONS.

May 7—National Park Station. Train, 1.14 p.m. Autumn Leaves. Mr. A. J. Morison.

May 21—Waite Arboretum. Tram, 2 p.m. Dr. A. E. V. Richardson.

June 4—Largs. Shells.

June 11—Museum. Gate, 2 p.m. General. Mr. H. Hale.

June 25—Forest Range, Motor, 2 p.m. Botany.

July 2—Largs Bay. Shells. B. C. Cotton.

July 16—Gandy's Gully. Tram, 2 p.m. General. Mr. E. H. Ising.

July 30—Pelican Point. Shells. B. C. Cotton.

August 6—Morialta. Tram, 2 p.m. Botany. Dr. J. B. Cleland.

August 20—Waterfall Gully. Tram, 2 p.m. Botany. Mr. J. R. Royle.

August 27—10 Clinton Avenue, Millswood. Tram, 2 p.m. Aviculture. Mr. Simon Harvey.

EVENING MEETINGS.

May 17—"Native Birds," Mr. F. E. Parsons.

June 21—Shell Club Evening, Mr. B. C. Cotton. Chairman.

July 19—Miss Eardley, Mr. G. H. Clarke.

August 16—Annual Meeting.

Bookings for the Special Excursions should be made with Mr. J. C. Clark, Town Hall, Adelaide. In the case of Motor Trips, ticket is to be paid for at time of booking.

Ghost Moths of the Family Hepialidae.

By NORMAN B. TINDALE, B.Sc., South Australian Museum.

Ghost Moths derive their popular name from the common English and North European species, *Hepialus humuli* Linne. The males of this insect are snow-white in colour and have a peculiar hovering flight. With their white wings flickering in the feeble light of dusk the males move over the hedgerows awaiting the appearance of the more somberly-clad female, and their flutterings have been mistaken for the visitations of some supernatural being.

Ghost moths belong to the suborder Homoneura, the most archaic branch of the Lepidoptera, which includes the moths and butterflies.

They derive their subordinal name Homoneura, meaning " similar veined," from the fact that the numbers and positions of veins visible in both the fore-wings and hind-wings are almost identical. In this character they show links with several other orders of winged insects, such as the Trichoptera or Caddis-flies and the Mecoptera.

Although the Homoneura are among the most archaic forms of Lepidoptera, their fossil remains have only rarely been discovered. A species (*Micropteryx proavittella* Rebel 1935) of the family Micropterygidae is the earliest known one. It was found in a piece of golden-yellow amber from the Baltic, and dates back to the Oligocene period. This species so closely resembles living forms that it is probable the main development of ghost moths and their allies took place much earlier, perhaps either in the Mesozoic or late Palaeozoic. A remotely related form, probably close to the ancestor of the Lepidoptera, and known as *Belmontia,* was found in the Triassic shales at Belmont, New South Wales, by Tillyard (1919).

About 140 species of ghost moths are known from the Australian Region, which is the centre of distribution for these insects; a further 230 species have been recorded from other parts of the world.

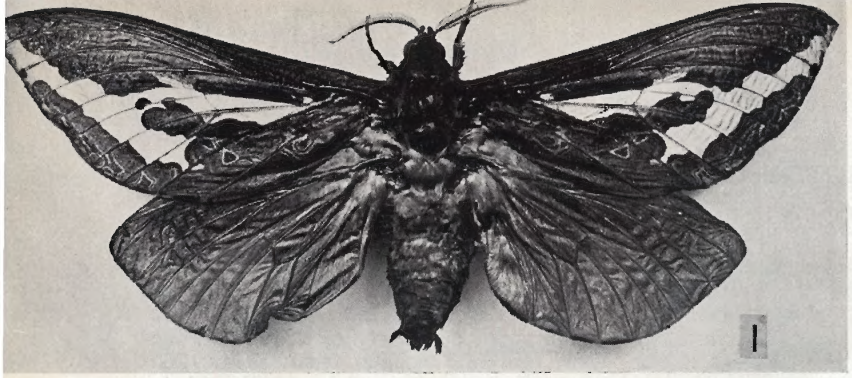
Moisture loving creatures, unable to withstand any great period of desiccation or drought, they are confined generally to regions with a relatively constant all the year rainfall, ranging from 30 to 150 inches. They seem to be on the whole intolerant of climatic change, and a species is consequently often confined to the restricted environment of one particular range of mountains. In such places the effects of climatic change may be relatively easily counteracted by migrations up or down the sides of the mountain, and the moths are thus able to remain always in the climate equivalent to that of their first choosing.

Examination of rainfall maps of our State, and especially a study of those depicting bioclimatic zones (Davidson 1936) suggests to us that the distribution of ghost moths is limited to those areas where the minimum annual rainfall approaches thirty inches, and is further restricted to such parts of these moderately high rainfall areas where, for six months of the winter period, together with at least one month of the summer period, the saturation deficit of the air is less than one half (i.e

$$\frac{P}{E} > 0.5).$$

Thus, Hepialidae occur in South Australia only in the South-East as far north as Pinnaroo; in the Mount Lofty Ranges, on Kangaroo Island, and on the southern-most point of Eyre Peninsula, where, for from seven to nine months of the year, moist conditions occur. They may also be expected to occur on southern Yorke Peninsula, but have not yet been taken there.

One species, *Oxycanus australis* (Pl.; fig. on middle right) occurs in the South-East near Robe, and along the Adelaide foothills. It may be taken as a general type of Australian Hepialid. In some previous, more pluvial, climatic period its distribution must have been much wider, but its *oekomene* has become restricted as moist



Trictena argentata (Herrich-Schaeffer), a large dark male example from Tasmania.

regions have contracted. *Oxycanus australis* expands four inches and its larvae feed on the roots of species of wattles. The adult moths emerge in autumn and survive for only a day or so, for they lack functional mouth-parts and are unable to feed.

Two species from the rich rain-forest areas of northern New South Wales are shown on our plate. *Oxycanus ballux* Tindale (top right) and *Oxycanus aurifex* Tindale (top left). In these East Coast areas the rainfall is high and so well distributed that the $\frac{P}{E}$ ratio is > 0.5 for the whole twelve months of the year. Another insect on the plate (middle left) is *Oxycanus stellans* Tindale, from Cockatoo, Victoria. It is a species which should be sought also in those parts of the South-East of our State where the climatic conditions are similar to those of the drier parts of Victoria.

One notable exception to the rule that Hepialidae occur only in regions of good rainfall has not been mentioned. This exception is all the more interesting because of its unusual character, and because the special features associated with it give us an insight into the adaptation necessary to an insect endeavouring to colonize an arid region such as the steppe lands of Central Australia.

A large species, known as *Trictena argentata* (Herrich-Schaeffer) has been taken on many occasions throughout South Australia (Fig. 1). It occurs commonly even in the remote regions of our Great Western or Victoria Desert. In the steppe land summer rainfall is scanty and unreliable and there is no winter rainfall at all.

In what way does this species differ from its relations, and why is it able to colonize the arid steppe lands as well as the well watered area of Southern Australia and Tasmania?

Before endeavouring to answer this query, let us consider the life history of the insect, so far as it is known. The pupae of *Trictena* can be found beneath the soil under the shade of red gumtrees (*Eucalyptus rostrata*) in the vicinity of Adelaide.

In autumn, after the insects have emerged, the golden-brown coloured empty shells protrude an inch or more from a long vertical tunnel, like that of a trap-door spider. These pupae had larvae which fed on the roots of the gumtrees, attaining a length of five inches and a thickness of one's index finger. The moth emerges at Adelaide in the evening of the first winter rains (usually in early April).

Almost immediately after fertilization the female lays upwards of 45,000 eggs, scattering them over the ground beneath the trees. She may die in the early hours of the morning or survive the day to conclude her egg-laying on the following night.

The adult *Trictena* moths are attracted to lights and fires, and Angas (1847) records that on the banks of the Lower Murray River these "large ghost moths fluttered into the embers in such quantities that the natives made a capital supper on their scorched and roasted bodies."

During the 1935 University expedition to the Warburton Range in the Great Western Desert, opportunities occurred of studying the larvae of this moth. The natives of Warupuyu, where we camped, are exceedingly fond of the grubs. They call them

GHOST MOTHS FROM AUSTRALIA AND INDIA.

Top left.—*Oxycanus aurifex* Tindale. Dorrigo, N.S. Wales, male, expanse 98 mm.
Top right.—*O. ballux* Tindale. Dorrigo, N.S. Wales, male, expanse 90 mm.
Middle left.—*O. stellans* Tindale. Cockatoo, Victoria, male, expanse 76 mm.
Middle right.—*O. australis* Walker. Robe, S. Australia, male, expanse 90 mm.
Bottom left.—*Phassus viridis* Swinhoe, Nilgiri Hills, S. India, male, expanse 86 mm.
Bottom left.—*P. punctimargo* Swinhoe, Senchal Range, Himalayas, female, expanse 110 mm.

mako tuuta, i.e. the grubs (*mako*) of the *tuuta*, or red gumtree. *Tuuta* trees grow on the low sandy banks and on the beds of wide waterless creeks, which only flow after the rare floods caused by summer rains.

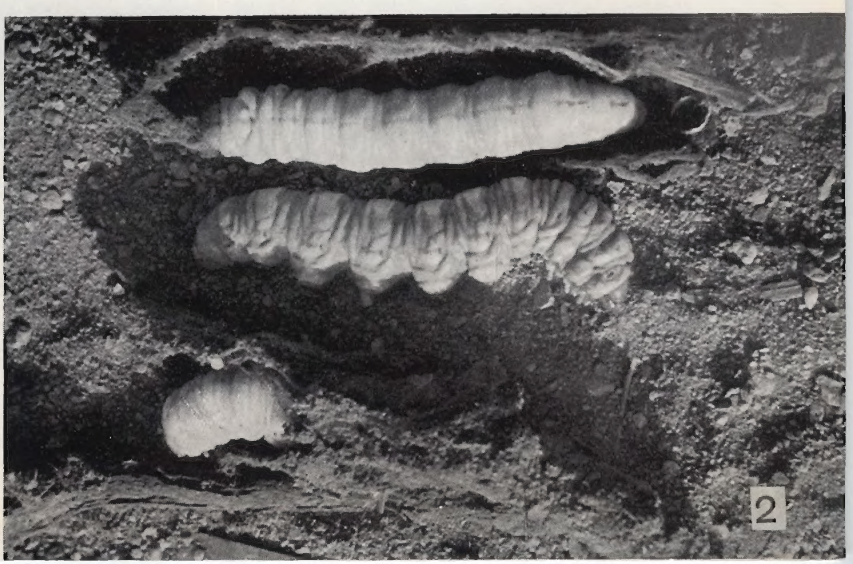
The natives discover the places where the larvae of *Trictena argentata* are likely to be working by observing minute cracks on the surface of the ground. In such places the earth has fissured and contracted during dry weather, cracking most readily above one or other of the lateral roots of the tree. They dig down along these cracks and find vertical silk-lined tunnels, commencing at a depth of about six inches. They examine the tunnels closely and smell the silken lining. If the material is damp, but has the correct odour, and if they see signs of freshly spun silk, they continue down several feet, using a native digging stick and their hands in excavating. By persisting in the search, grubs may be discovered, usually at depths of from four to five feet. The sand at this level is quite damp. Usually the grubs are deep down and much labour must be expended to obtain them, therefore, they are considered only as an occasional luxury. When the pupae work their way towards the surface just before rain falls in the summer season, they are more readily available as food. On the night when the moths emerge there is a great feast for the children, for the moths flutter wildly into the numerous fires which are built to attract them.

When rewards were offered strong efforts were made by the natives to secure supplies of *mako tuuta* grubs for me, even though it was mid winter and the grubs were to be found only at greath depths in the soil.

On one occasion when a grub was being dug out it was injured in the process; the native cooked it by laying it in the hot ashes of his camp fire for about half a minute. When the skin became taut with the warmed juices within it, he raked it out, flicked it with his fingers to remove the adhering dust, and offered it to me. It tasted like warm cream or the baked skin on roast pork, and was quite delicious.

Considering the difficulties the natives meet in securing this delicacy, it is probable that one could have partaken of few "rarer" dishes. Fig. 2 shows two views of larvae three and a half inches in length, also a view of the lower extremity of a silken tunnel with the larva in it and a portion of a root showing marks of attack by the caterpillar.

The larvae feed externally on the roots, and at the stage depicted are generally to be found attacking those of a diameter of half



Larvae of *Trictena argentata* at the Warburton Ranges.

an inch and upwards. The tunnels were always vertically placed and terminated below with a transversely placed silken plug.

In a test 66.5 grams of the moist sandy, red earth surrounding a larva at a depth of five feet was found to contain 7.5 grams of water, indicating a moisture content of more than 11 per cent. by weight.

In this relatively high moisture content of the soil of the larval environment, we seem to see the reason why *Trictena* can be an exception to the rule that *Hepialidae* only occur in regions of relatively constant and reliable high rainfall. As the moth appears on the wing for only a brief, irregularly timed period just after heavy rain, when the desert blossoms and the air is temporarily moist, it does not suffer from the effects of drought. The eggs hatch rapidly after falling on the ground, and the young larvae retreat deeply into the moist sandy soil of the river bed, modifying their position so as to remain in a suitable climatic environment, despite the arid conditions reigning above them on the surface of the ground. *Trictena* is " the exception that proves the rule."

Many other interesting problems are associated with the Hepialidae.

The economic importance of some species of ghost moths is great because of their attacks on pasture grasses, and also because of the depredations of others as feeders on the roots of trees as well as timber borers.

Because of their archaic form they act as " indicators " to those who would study the origins and evolution of the Lepidoptera. Their association with the old land masses of the earth is rather marked, and their study may help to elucidate some of the problems of the breaking up of the old land mass of Gondwanaland, of which fragments are believed to survive in Peninsular India, South Africa, Southern South America, and Australia.

The two bottom figures on the plate depict Hepialid moths, allied to the Australian ones, which live in India. *Phassus viridis* Swinhoe (bottom left) is a strange green species from the mountain plateaus of the Western Ghats in Southern India, while *P. punctimargo* Swinhoe is a timber-boring species from the Himalayas near Darjiling, where it attacks giant *Cryptomeria* trees (Plate, bottom right).

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I am indebted to Miss R. Veale and to Miss M. Gilpin for preparing the figures shown in the coloured plate.

Biological Control of Prickly Pear.

(By W. A. TOUGH.)

This year 1938 marks also the 150th anniversary of the introduction of prickly pear into Australia, for it is asserted that plants were imported in 1788 from Brazil by Governor Phillip for the early settlers in New South Wales to plant around homesteads as a barrier against the attacks of hostile aborigines. The species introduced was the Smooth-trunked Tree Pear—*Opuntia vulgaris* (=*monacantha*)—found in this State. Although this species *A. vulgaris* is the most widely spread variety in the Commonwealth, it is probably the least important as regards area of occurrence and the ease with which it may be eradicated. Compared with the main pest pear of Queensland and northern New South Wales, *Opuntia inermis*, which at the end of 1925 covered 60,000,000 acres (an area greater than that of Great Britain) and was spreading at the rate of 1,000,000 acres per annum, the infestation of prickly pear in South Australia is negligible. Isolated patches occur around Salisbury, Seaton Park, Mount Barker, and in the Middle North, but now that the means of extermination are available and the co-operation of the Department of Agriculture and the local governing bodies is assured, this State should be entirely free of the pest in a few years.

From personal observation it appears that the fruit of *O. vulgaris* does not ripen sufficiently here for the seeds to mature, and the plant to be spread by the droppings of birds, as occurs in the Eastern States.

Distribution in South Australia is usually from plants growing on water courses from which stem-segments are broken and carried downstream to take root wherever they are deposited. Prickly pear is a very hardy plant. Instances have been observed where new stems have sprung from pieces of pear hung on a fence to die, out of contact with soil and water.

In many cases the prickly pear is in the form of very old hedges of which there are, at least, ten around Salisbury. One at Pooraka is believed to have been planted about seventy years ago in a clump about a half mile long. The hedge spread outward to a width of about 200 feet and the plants grew to a height of twenty feet with trunks eighteen inches in diameter. About a third of the length of this hedge was effectively destroyed with arsenic pentoxide about fourteen years ago, but it is believed that the process was expensive, and it appears that the soil was rendered sterile as it has since drifted very badly due to its bareness. It will be noticed that the growth and spread were very slow, considering the age of the plants, as, compared with Queensland, the climate of this State fortunately not being suitable for the rapid spread of prickly pear.

After unsuccessful attempts had been made to cut down the pear and to crush it down with a tractor, 50,000 eggs of the moth *Cactoblastis cactorum* were attached to the leaves on 18th March, 1934, but it is believed that a large percentage of the egg sticks was destroyed by predators. Larvae were first noticed on 6th April, 1934, and seemed to thrive on the pear. The second generation appeared about 8th January, 1935, but, instead of multiplying by 75 to 100 per cent., their number had not appreciably increased. The larvae pupated around the end of February, but no moths were ever seen, and no further trace of this insect was detected after this date. Possibly their disappearance was due to sphegid wasps preying on the larvae and exercising a greater degree of control than is common in Queensland, but probably it was due to unsuitable climatic conditions (hot, dry weather over a prolonged period).

It is understood that later experiments with *Cactoblastis* elsewhere in this State have also been unsuccessful.

On 26th May, 1934, a case of cochineal-infested pear was distributed throughout the pear belt at Pooraka. By June, 1935,

Prickly-Pear at Pooraka, showing Cochineal Insect widely spread and beginning to work.

the infestation had become very dense along the whole length of the hedge, although it was observed that the infestation was definitely more numerous along the northern side, which has the benefit of more sunlight and greater protection from the prevailing winds in the winter.

In his bulletin on "The Progress of Biological Control of Prickly Pear in Australia," Mr. Alan P. Dodd states:—

"Cochineal insects are members of the genus *Dactylopius*, and belong to the mealy-bug section of the scale insect family (Coccidae). Several species are known, and all are restricted to feeding on prickly-pears and other cactus plants.

"The small soft-bodied insects are sheltered beneath a white woolly or downy secretion of fine silky threads. The males are very small delicate-winged flies; the females are wingless. The eggs are laid in numbers beneath the body of the female.

The young cochineal or "crawler" is possessed of normal legs, but, when a suitable feeding spot has been located, its trunk or proboscis is forced through the cuticle, and for the rest of its existence it remains stationary; the legs gradually atrophy and the woolly covering is secreted; the trunk serves to attach the insect firmly to the plant, and attempted removal results in its death. The females are prolific; during the summer, a new brood is produced every few weeks. The crawlers are so small that they can be carried great distances by wind; this method of dispersion explains the rapidity of cochineal spread, and the fact that isolated plants, many miles from other pear clumps, are infested with colonies.

"The Indian cochineal, *Dactylopius indicus*, was introduced from Ceylon by the Queensland Travelling Commission in 1913, and was established successfully at Dulacca by Dr. Jean White-Haney. Another strain was imported from Argentine by the Board in 1925, but, like its predecessor, has not been induced to attach any other prickly-pear except *Opuntiia monacantha*.

Considerable areas of *monacantha* in North Queensland were rapidly eradicated by *indicus*, and the scattered infestation of this prickly-pear from Queensland to Victoria has been controlled so efficiently that at the present time occasional plants only can be found."

The effect of the *Dactylopius indicus* feeding upon the pear is that the leaves turn from dark green in colour to a sickly yellow, become limp and droop, and

finally have the appearance of crumpled brown paper. The big solid trunks first become pulpy and malodorous, like a rotting potato, and then dry up, losing all moisture and consisting only of the bark and fibre. Presumably the last of the cochineal have by this time died of starvation, owing to the supply of sap being exhausted. In this condition the pear plant may be destroyed by burning.

When quite dry the burning is very fast and complete, as the whole of the plant is reduced to a fine powdery white ash, but after only a few points of rain the mulch of dead leaves seems to absorb the moisture and become peaty and saturated, and the fire may smoulder for a week.

The prickly pear at Pooraka is probably the largest single clump in the State, and this has been completely killed in less than four years, and will shortly be entirely removed by burning. In addition, the cochineal infestation has during this period spread over the whole of the pear in the Salisbury district due to the young crawlers being air-borne for many miles. This eradication is due to a consignment of a fruit-case of infested pear which had to be protected and sheltered until the infestation had spread. It is, therefore, probable that with an unlimited supply of culture now available, owners desirous of ridding their land of prickly pear may do so in a much shorter time than four years, and the precautions for the careful protection of the initial distribution of the culture are no longer necessary.

Owing to the ease with which it can now be eradicated, *Opuntia vulgaris* was declared a noxious weed in South Australia on the 14th April, 1937, and must now be destroyed.

Acknowledgment of their very helpful advice and assistance is due to Professor T. Harvey Johnston, of the University of Adelaide, Mr. H. Womersley, Entomologist of the South Australian Museum, and to Mr. Alan P. Dodd, Officer-in-Charge of Prickly Pear Investigations, Commonwealth Prickly Pear Board, from whose Bulletin, quoted above, is collected most of the detailed information set out herein. To these gentlemen I render my thanks. The balance of the data is based on my own personal and usually very painful experiences in the eradication of prickly pear.

The same after the Cochineal had killed the Prickly-Pear.

Octopus, Squid and Cuttlefish.

Advanced Models in Shellfish.

By BERNARD C. COTTON.

That the sedentary oyster and the sluggish cockle can have such speedy, efficiently equipped near-relations as the Squid and Cuttlefish seems astounding. Yet it is true that the Cuttlefish is a much improved shellfish, streamlined for speed, provided with keen eyesight, eight strong arms set with numerous suckers, two long retractile arms for grasping its prey and an ink bag, which provides a defensive fluid "smoke screen." In the dark depths of the ocean even better equipment is provided for the Squid denizens. Chemical lights are arranged on the skin in geometrical patterns and greatly developed telescopic eyes provide better vision to cope with the surrounding darkness.

This large South Australian Octopus, *Octopus flindersi*, is common, and grows up to three or four feet in length.

Three modes of progression are available to the Cuttlefish; it can creep with the arms, move head foremost by rowing with the muscular fins, or with flashing speed dart backwards in that amazingly quick manner peculiar to its kind. This backward motion is achieved by violently squirting seawater from a funnel which forms the outlet to the water circulation over the gills, the fins being used for steering.

So that the water inlet will not leak while pressure is being applied for forcing water through the outlet funnel, an ingenious hook and eye arrangement effectively seals this aperture.

The shell so characteristic of the cockle and whelk is much reduced and internal in the Squid and Cuttlefish and entirely missing in the Octopus. The Octopus shown here, *Octopus flindersi*, is frequently found in South Australia, and adults usually measure about four feet in length. The tips of the arms are frequently bitten off, but they grow again. A photograph appears in "The Observer," Adelaide, February 18, 1911, p. 30, of an Octopus about eight feet long, that is sixteen feet across the arms from tip to tip and the body has the width of a man's head. It may be a large specimen of *Octopus flindersi*. It was taken in Spencer Gulf. In the Southern Squid, *Sepioteuthis australis*, shown here, the shell is reduced to a thin, horny,

Above—

The Southern Squid, common in South Australia, is extensively used as whiting bait.

Below—

The Giant Cuttlefish from South Australia is probably the world's largest species.

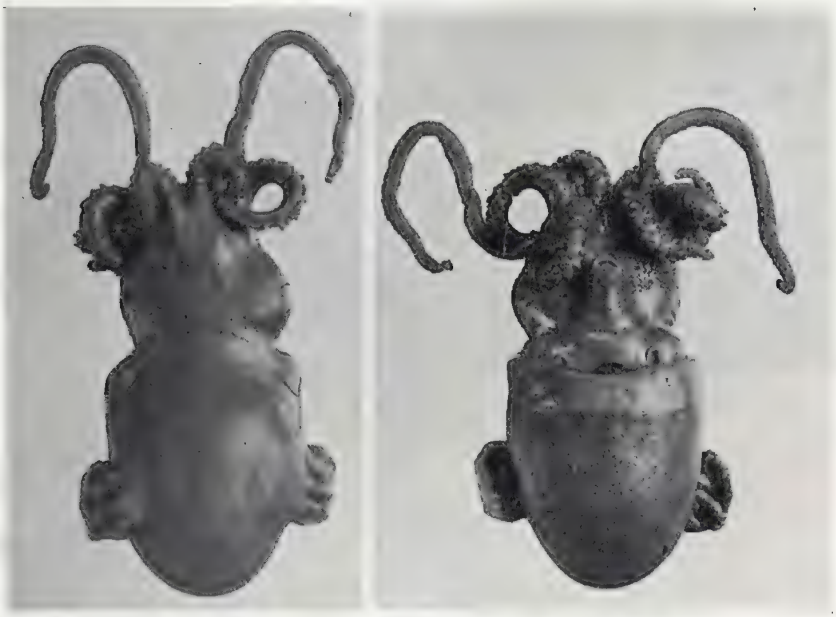
quill-pen-shaped "backbone." In the Giant Cuttlefish, *Sepia apama*, also shown here, the "backbone" is the well-known white chalky object so frequently found on the beach. This "bone" is powdered for use in toothpaste and has been used experimentally for packing fruit. The Giant Cuttlefish figured measures two feet eight inches long and is probably one of the largest in the world.

A life-size model of it is exhibited in the South Australian Museum.

The Southern Squid is much less in size, measuring about twelve inches in length. Seen in life its rapidly changing colours, translucent flesh, large, sensitive eyes, rhythmic actions and flashing speed leaves one entranced. This species is common in South Australia, is used extensively as whiting bait, and eaten by some Southern European members of the population. Squids form the whale's chief food and it is the Squid's horny jaws remaining undigested in the whale's stomach which set up an irritation causing a discharge known to us as the valuable ambergris.

Giant Squids fifty feet long with eyes fifteen inches across are known to science, but an unknown scale-covered species also exists, as a piece of one has been taken from the stomach of a sperm whale.

It is just possible that the long tentacular arms of the Squid are responsible for some of our best sea-serpent stories, as they certainly have the appearance of a so-called sea-serpent.



A small Squid, *Euprymna tasmanica*, rarely taken in South Australia, is shown here in natural size.

Flora of the Wudinna District,

Eyre Peninsula.

(By C. W. JOHNS.)

Species Inhabitating the Granite Outcrops and their Immediate Surroundings.

The height of the outcrops, of which there are several in the district, vary from fifty feet to nearly 600 feet, and the average annual rainfall is a little over eleven inches. Although Goyder's line passes slightly to the north, coastal showers frequently penetrate into the district in winter, and to a less extent in spring. The bulk of the rain occurs during winter. Soils derived from the outcrops are of a red sandy nature overlying granite or limestone, which latter rarely overlaps the granite. On the rocks and ledges it is composed of chips with varying amounts of organic matter.

On the outcrops themselves pools of water collect in winter and in them grow *Crassula recurva, Limosella aquatica,* and *Glossostigma Drummondii.* In the turf, which receives drainage water from the rock, a very large and interesting number of species occur during winter and spring and are noteworthy for their dwarf habit and the speed at which they complete their life cycle. Usually the turf is only a few inches deep, but this factor probably helps it to maintain its temperature with the brief snaps of sunshine in winter. Many of the species occur in other parts of the State growing in perhaps diverse habitats and in districts of better rainfall, and there they doubtless grow into much larger specimens and take longer to develop.

The first of the ephemerals to appear is usually *Ophioglossum coriaceum,* followed by *Anguillaria dioica, Hypoxis pusilla, Triglochin elongata,* and *T. centrocarpa, Brachycome perpusilla, B. pachyptera, B. ciliaris Plagiobothrys plurisepalus, Lappula concava, Crassula colorata, C. Sieberiana, C. bonariensis, C. pedicellosa, Centrolepis strigosa, Plantago varia, Isoetopsis graminifolia, Calandrinia pygmaea, Helipterum pygmaeum, Millotia tenuifolia, Toxanthus Muelleri, Gnaphalodes uliginosum, Chthonocephalus pseudevax, Levenhookia dubia, Erythraea Centaurium* appears later in the spring and is capable of producing its seed in about two weeks from its first appearance.

A little further back from the rock border and where the turf deepens, we find *Stypandra glauca*—the leaves and stems of which were used by the early settlers for thatching their shanties. Around these *Stypandra* plants and amongst them occur *Microtis porrifolia,* and a Sundew (*Drosera Planchonii*) climbing up to expose its flowers to the sun by means of a viscid fluid exuded from the tentacles of the leaves and thereby securing itself to neighbouring support. *D. glanduligera* also occurs, but higher up on the rock levels only. Around and amongst the above *Stypandra* Lily one also finds *Galium australe* and the Parsley Fern, *Cheilanthes tenuifolia* (this fern appears to be impartial to shade or sun, but dries off quicker at the advent of hot weather when exposed). In similar situations one finds the Bluebell (*Wahlenbergia*) growing in two forms—one of which is glabrous whilst the other is hairy with floral parts in fours and opposite leaves.

Other species occurring in the wet turf are *Sagina apetala, Gnaphalium indutum, Helipterum australe, H. demissum, Rutidosis multiflora, Angianthus strictus,* and *Quinetia Urvillei* all very dwarf and usually under 5 c.m. in height. In some seasons with poor winter rains, which are insufficient to keep the turf moist enough for growth, many of these species do not appear, and the seed lies dormant, therefore, the observer must spread his activities over many seasons.

On the ledges and crevices *Isotoma petraea* flourishes, as also does *Pomax umbellata*, *Hybanthus Tatei* and *Pleurosorus rutifolius* (fern) usually completely shaded under a ledge.

In the rock debris three Legumes (*Indigofera australis*, *Glycine clandestina*, and the Scarlet Runner, *Kennedya prostrata*) grow to profusion. The shady side of a ledge appears to be the habitat of the somewhat rare poppy, *Papaver aculeatum*. In the open gravel at high elevations *Hibiscus Huegelii* var. *leptochlamys and Prostanthera striatiflora* make a good show, whilst on the drier sunny side we find *Carpobrotus acquilaterus*. Around the base of Mt. Wudinna and other rocks the following have been noted:—*Loudonia aurea*, *Halorrhagis heterophylla*, *Didymotheca thesioides*, *Muehlenbeckia adpressa*, *Lavatera plebeja*, *Dampiera rosmarinifolia*, *Acacia pycnantha*, *A. continua*, *A. calamifolia* var. *euthycarpa*, *Mitrasacme paradoxa*, *Stackhousia monogyna*, *Melaleuca linophylla*, *Gyrostemon ramulosus* (the latter being represented by a single male bush), *Pomaderris racemosa*, *Opercularia varia* and a *Nicotiana* species, and a number of others more widespread. Also several grasses and sedges not yet identified. In addition, quite a number of aliens appear, and in many instances are crowding out the native flora. About thirty of the above species appear to be of Southern origin, eleven of Northern origin, eleven common to all the State, and five representing endemic Australian genera and the remainder of uncertain origin.

Field Naturalists' Evening Meeting,

16th November, 1937.

Exhibits by E. H. ISING.

Stypandra glauca.—Collected on Eyre Peninsula and recorded for the first time in our State in 1935.

Erodiophyllum Elderi.—A beautiful purple daisy from Koomooloo Station, east of Burra. A rare plant and noted for the hard flower heads formed when in fruit.

Kangaroo Island Plants.

Collected by Mr. W. D. WADE, May, 1937

Lasiopetalum Schultzenii.—A rare plant and noted for its beautiful leaves and velvety covering.

Olearia teretifolia.

O. ramulosa.

O. floribunda.—Three daisies for comparison.

Helichrysum adenophorum.—One of our largest and best white everlastings.

Styphelia exarrhena.—A rare plant, and this is the first record of the species being found on Kangaroo Island.

S. exarrhena var. hirtella.—A similar white heath to the former, but the hairiness of the plant gives it a characteristic appearance.

Leucopogon Woodsii.—A rare heath.

L. rufus.—A wiry, hard leaved species.

L. parviflorus.—A common white heath.

Eucalyptus diversifolia.—A mallee often growing only three feet.

E. cneorifolia.—The narrow-leaf mallee from which the eucalyptus oil of commerce is extracted. Only native to Kangaroo Island, except a few clumps at Encounter Bay.

Adenanthos sericea var. brevifolia.—A low spreading shrub which does not occur on the mainland.

A. terminalis.—A shrub of a similar habit to the preceding, but much more common, occurring mostly in sandy soil from Mt. Lofty Range to the South-East.

Hakea rugosa.—MacGillivray.—A shrub widely spread in the State.

H. ulicina var. flexilis.—Found at MacGillivray.

Choretrum glomeratum.—A nice shrub with numerous slender branches and white flowers.

Gyrostemon australasicus.—A species somewhat rare and known as "tomato bush."

Acacia longifolia var. Sophorae.—Found at Mt. Thisbe.

A. myrtifolia var. angustifolia.—A variety endemic to the Island and found at American River.

A. rupicola.—Pt. Morrison. Not very plentiful in our State anywhere.

Correa rubra.—A form with orbicular to ovate leaves and with flowers red in the lower half and yellow above.

C. rubra var. glabra.—Leaves ovate to oblong and reddish flowers.

Dodonaea humilis.—A decorative plant with scarlet fruits and dark-green leaves.

Excursion to Botanic Gardens,

26th February, 1938.

The Director of the Botanic Gardens, Mr. H. Greaves, led a large party through various sections of the garden. The Australian section was first visited along the south wall, and the excellent growth of many of the species was commented upon.

Grevilleas, Acacias, *Hibiscus Huegelii* and Sturt's Desert Rose (*Gossypium Sturtii*) were noted as doing well. The Fern House is a mass of luxuriant foliage and many types of ferns were admired. A fine bushy tree of *Eugenia paniculata*, with red fruits and shiny leaves, was seen and it is one for planting in parks and gardens. Some large trees, many years old, were observed of the spotted gum (*Eucalpytus maculata*), black ironbark (*E. sideroxylon*), tuart (*E. gomphocephala*), which is perhaps a timber of the highest quality for durability and strength, yellow box (*E. melliodora*) now the biggest tree in the garden and one which the Director remembers as a big tree forty years ago, it is also the oldest tree in the garden. A specimen of the Kangaroo Island mallee was pointed out (*E. cneorifolia*) and it is from this plant that the eucalyptus oil of commerce is extracted. Two trees closely allied to the gums (Eucalypts) were noted, the cabbage "gum" (*Angophora lanceolata*) and the apple (*A. intermedia*) both are members of the coastal region of the eastern states. The palm house was a picture of beauty, freshness and loveliness. The Director was heartily thanked by Messrs. M. T. Winkler and W. D. Wade on behalf of the members.

Visit to Mr. Edwin Ashby's Garden, Blackwood,

12th March, 1938.

Mr. Ashby first described the formation of his latest addition to his garden in the Alpine rockery. He informed the visitors of all the work he had put into this feature and gave his reasons for his method. The slope and aspect had a very important part to play in the success of the plants placed among the rocks, and with ordinary care a large number of varieties would do well.

Our host has recently planted a number of Erythrinas from South Africa, all of which are noted for their large handsome scarlet flowers. In a general walk through the garden a large number of plants were seen in flower, and the fact was impressed on the members that many of our Australian plants bloom in the most unfavourable time of the year. Mr. Ashby's very large collection of Cacti was inspected, and members were surprised at the variation of the various forms. Mr. A. K. Newbery and Mr. A. J. Wiley expressed the thanks of the members.

FIELD NATURALISTS' SECTION OF THE ROYAL SOCIETY.

Publications of the Section.

PUBLICATION No. 1.

The National Parks of Australia, by Wm. H. Selway.
(Out of print).

PUBLICATION No. 2.

Geological and Botanical Notes on the Victor Harbour District
by
Prof. J. B. Cleland, M.D., and Prof. Walter Howchin, F.G.S.

Price 1/-.

PUBLICATION No. 3.

Botany and Geology of Coast from Outer Harbour to Sellick's Beach
by
Prof. J. B. Cleland, M.D., and C. Fenner, D.Sc.

Price 1/6.

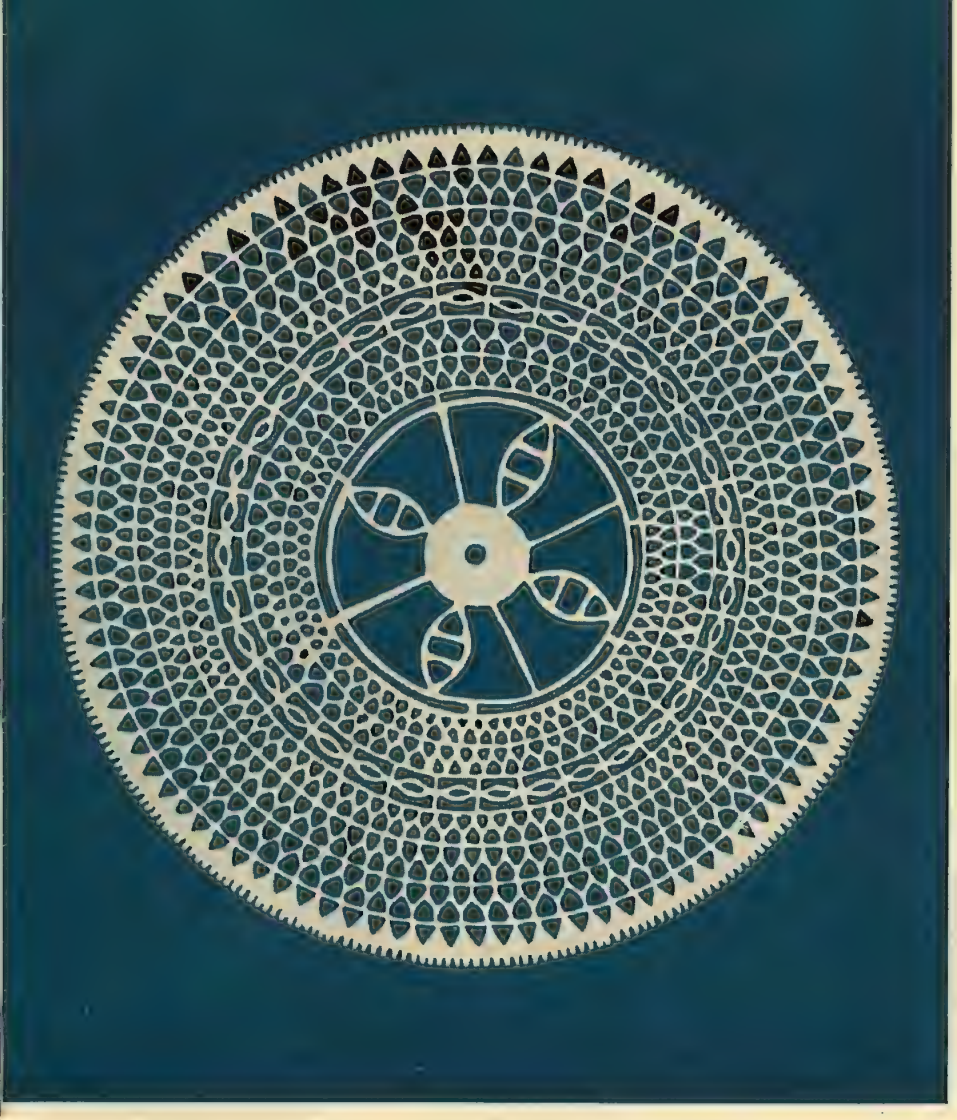
PUBLICATION No. 4.

NATIONAL PARK.

Price 1/6

Obtainable at Rigby Ltd., 16 Grenfell Street, Adelaide, S.A.

The Advertiser Printing Office, Adelaide



KAP KAP ORNAMENT.

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OCTOBER 31, 1938.

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"South Australian Naturalist":

Editor—Mr. B. C. COTTON, The Museum, Adelaide.

EXCURSIONS:

1938.

November 12—Torrens Valley. Tram, 1.30 p.m. General. Mr. L. J. Wicks.

November 19—Brighton. Train, 1.11 p.m. Shore Life. Mrs. G. Edmeades.

November 26—Crafers. Motor, 1.30 p.m. Botany. Mr. W. D. Wade.

December 10—Marino. Train, 1.11 p.m. Loricates. Mr. W. M. Nielsen.

EXCURSION TO MELROSE.

Alteration of Date.

The correct date for leaving is Monday, December 26. The train leaves at 8.5 a.m. and arrives at Melrose at 3.28 p.m. The fare is 25/4 excursion return. Hotel accommodation is 8/- per day.

Leader, Mr. E. H. Ising; subject, Botany and General. The leader proposes to return on Thursday, 29th inst., leaving at 8.13 a.m. (arrive in Adelaide at 3.20 p.m.).

Members are advised to take old clothes, strong boots or shoes and a haversack with a thermos flask, as it is intended to make an all day trip to climb Mt. Remarkable.

January 21—Pelican Point. Train, 1.10 p.m. Sand Flat Life. Mr. B. C. Cotton.

January 30—Victor Harbour. Train. Physiography. Dr. C. Fenner.

February 4—Blackwood. Train, 1.14 p.m. Experimental Orchard. Mr. R. Fowler.

February 18—Burnside Road, Kensington Gardens. Tram, 2 p.m. Aviculture. Mr. F. Basse.

EVENING MEETINGS:

November 15—Exhibit Night, Mr. W. M. Nielsen, Convener.

1939.

February 21—Conversazione, Mr. L. A. Elliott.

March 21—"How the Microscope Assists the Naturalist," Mr. W. A. Harding.

April 18—"Western Australian Wild Flowers," Mrs. L. A. Greaves.

May 16—Shell Club Evening, Mr. B. C. Cotton, Chairman.

June 20—"Across the Continent and Back in Two Days, Mr. S. R. Harry.

July 18—"The Koonamore Vegetation Reserve," Prof. J. G. Wood.

August 15—Annual Meeting.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Bookings close with the Secretary or Treasurer three days before excursion, and seats will be allotted in order of priority.

Kap Kap Ornaments from New Ireland

By C. P. MOUNTFORD, Acting Ethnologist, South Australian Museum, and
ALISON HARVEY, Honorary Assistant in Ethnology.

To decorate oneself seems to be inherent in the human family. The most primitive races in the world delight in some form of personal ornamentation. The Australian native, under the mistaken notion of beauty, thrusts a large bone through the nose, supposing thereby that his appearance is enhanced, a supposition with which every European will disagree.

For the same reason the modern maid bedecks herself with gaily-colored ear-rings and other attractive jewellery, but no logically-minded person will agree that the addition of these trinkets adds to the beauty of the wearer. True, the ornaments themselves may be exquisite pieces of workmanship, and the stones spots of scintillating colors, but even that does not make a beautiful face more attractive or enhance the appearance of some less fortunate sister.

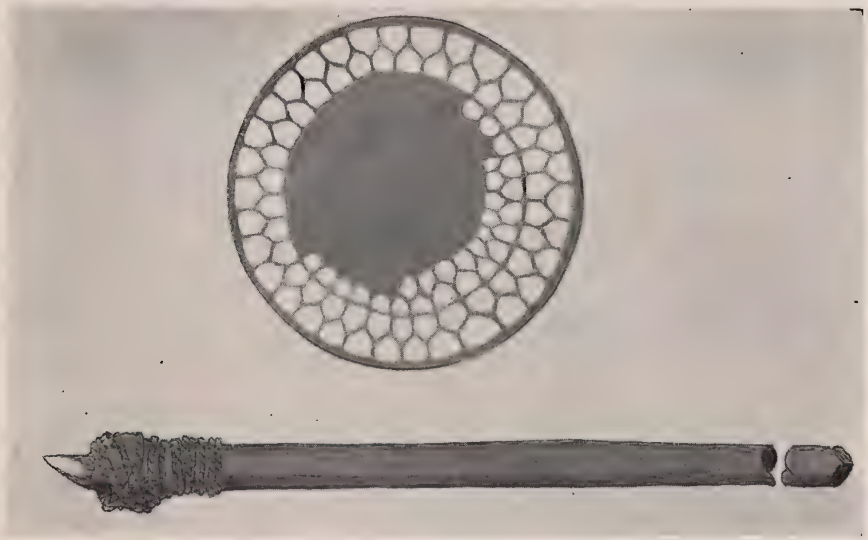
Another kind of ornament, however, fulfils two uses; it still serves the purpose of decoration, and, in addition, acts as a charm that brings good luck to the wearers or protects them from harm or injury.

Many such are known to us; the swastika, a Babylonian symbol, which was considered, before Hitler decided that it should be the national insignia of his country, an omen of good fortune; jade, supposed Chinese and Europeans alike to be both a harbinger of good luck and a particularly efficacious protection against misfortune; and amber necklaces, which are still believed, even by some normally well-educated and intelligent people, to be a preventive against chest troubles. Many other charms, such as horseshoes, black cats, and nesting swallows are well known to us.

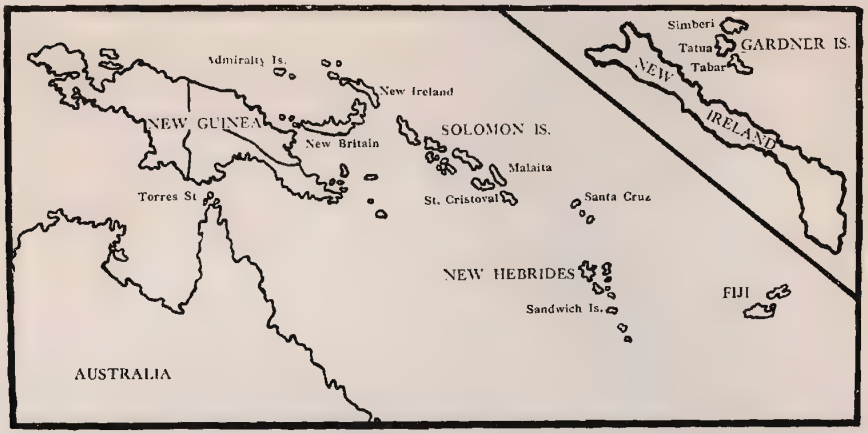
For centuries the artistic efforts of the finest craftsmen in the world have been expended in making of pieces of carved jade, amber, and gold. These were used by the people of long ago as amulets or lucky charms, amulets that served to please the eye because of their beauty, as well as to protect and bless the wearer by their virtue.

The amount of highly-skilled labor involved, as well as, in many cases, the rarity of the material employed, made many such articles unobtainable except by the wealthier members of the community.

When the late Mr. E. R. Waite, the Director of the South Australian Museum, visited New Ireland in 1919, he brought back a considerable number of exquisitely fretted pieces of tortoiseshell. These, to the natives of



Tool for cutting tortoiseshell ornaments, and an unfinished example.



Area in which pierced tortoiseshell ornaments are made.

those islands, combined the three virtues already mentioned, that is, personal adornment, good luck charms, and symbols of wealth.

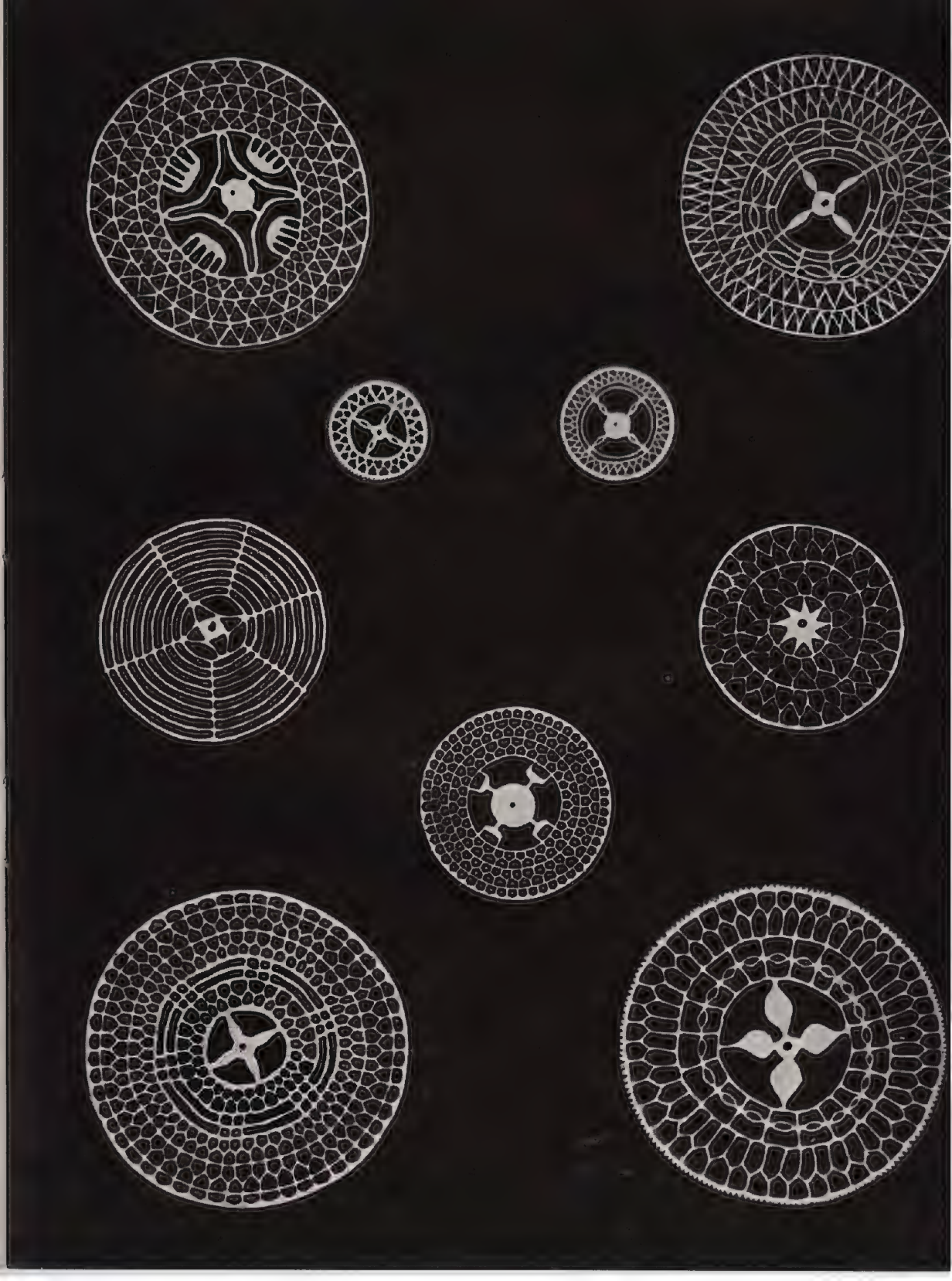
The smallest examples, two of which can be seen opposite are worn by the women as a tight necklet. Others, larger and more ornate, such as shown on the top and bottom of the same illustration, decorate the men when they set out on war or raiding parties, for the New Irelander believes that the wearing of such an object is sufficient to prevent him being wounded in battle. Such ornaments are, indeed, so highly prized that they are used in the purchase of pigs and wives.

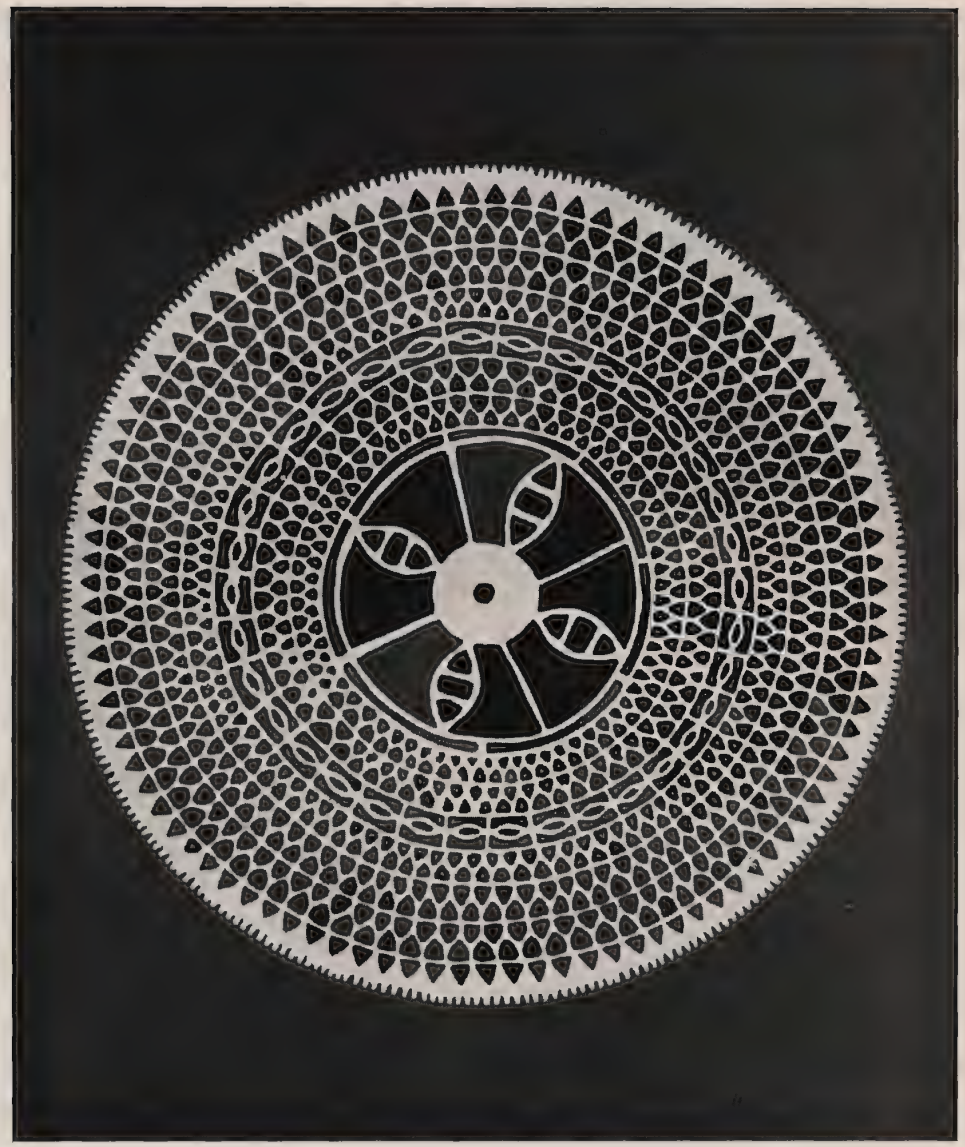
These ornaments, known to the New Irelanders as *Kap Kap*, are discs of tortoiseshell which have been ground down until they are no more than half a millimeter in thickness (that is, about one-fifteenth of an inch). With infinite patience the natives, with particularly simple tools, have fretted these thin discs into delicate filigree-like signs, several of which are shown on opposite page. In order to protect these fragile ornaments from injury, they are worn on a shell plaque ground from the shell of a giant clam (Tridacna sp.), as shown on page 5.

Some of these ornaments, of which the illustrations opposite are about four-fifths full size, are finely fretted that it is astonishing how the native, with a crude tool composed of no more than a shark's tooth, mounted on a short stick about four inches in length, could have produced an object in material as brittle as tortoiseshell.

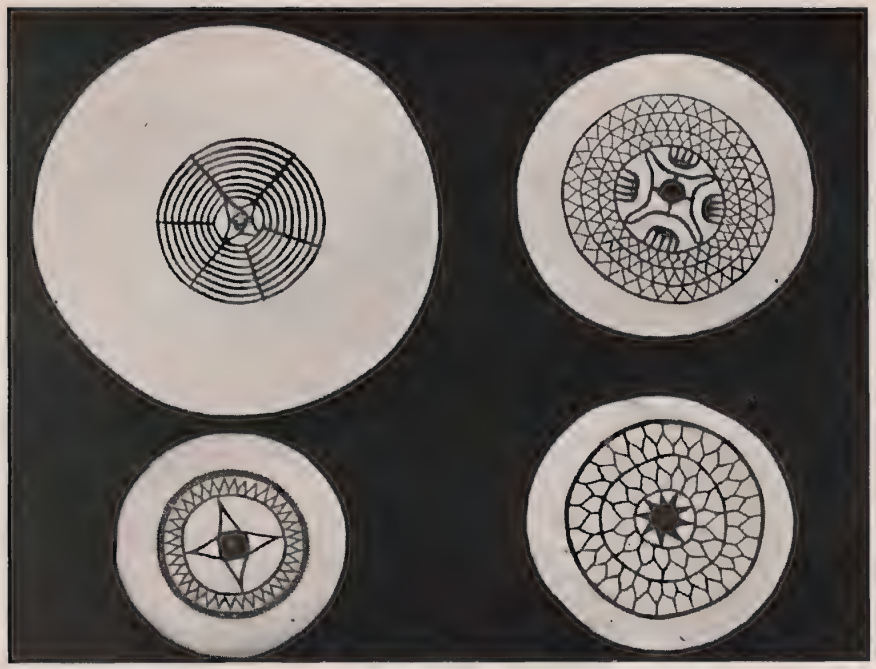
It was fortunate, also, that Mr. Waite was able to obtain a partly-finished Kap Kap ornament, and the tool that produced it. These are illustrated overleaf. As is to be expected, these Kap Kap ornaments are only owned by the wealthy, and small wonder it is, when one considers how many hours of painstaking work must have gone into the making of one such as the upper centre example shown on this plate, not to mention the most beautiful of all known to the writers, that shown in full size on the frontispiece. This example was collected from the mainland of New Guinea by Captain W. E. Sansom, and it is through the courtesy of his brother, H. G. Sansom, that this specimen is available for study.

Designs of pierced tortoiseshell (Kap Kap) ornaments from New Ireland.





Pierced tortoiseshell ornament from New Guinea.



Pierced tortoiseshell ornaments from New Ireland, fitted on shell plaques.

These ornaments are known in many islands of Oceania. Examples have been found in Admiralty Is., New Ireland, New Britain, and the Gardner group in the New Britain archipelago, westward in New Guinea and the Torres Strait Islands, and in the Solomon Is. and Fiji to the south. The inset map shows the position of the tiny Gardner group in the New Britain archipelago.

The plotting of these and other positions on the accompanying map shows that they are found only in Melanesia, although the Ethnographical album of the Pacific by Edge-Partington and Heape (p. 27, vol. III) illustrates a head dress with similar ornamentations from the Marquesas group. Except for the one example mentioned, they are not used, so far as the writers could ascertain, by either the people of Polynesia or Micronesia.

A Limestone Cave at Swan Reach

RIVER MURRAY, SOUTH AUSTRALIA.

By L. W. PARKIN.

The investigation of a cave at Swan Reach, South Australia, was the main objective of a field expedition held in December, 1937, by students of the Natural Sciences in the University of Adelaide. The expedition was the outcome of a move among the students to form a society to promote the undertaking of field research, and the members of the party are the nucleus of the since formed Ralph Tate Society.

The Murray River at Swan Reach, as elsewhere in South Australia, flows in a valley incised in the Miocene marine (Janjukian) and Pliocene (Kalimnan) sediments of the Tertiary Murray Gulf. The valley has usually one steep cliff face alternating from one side to the other according to the convexites as the river meanders, the opposite side sloping more gently up to the general plateau level.

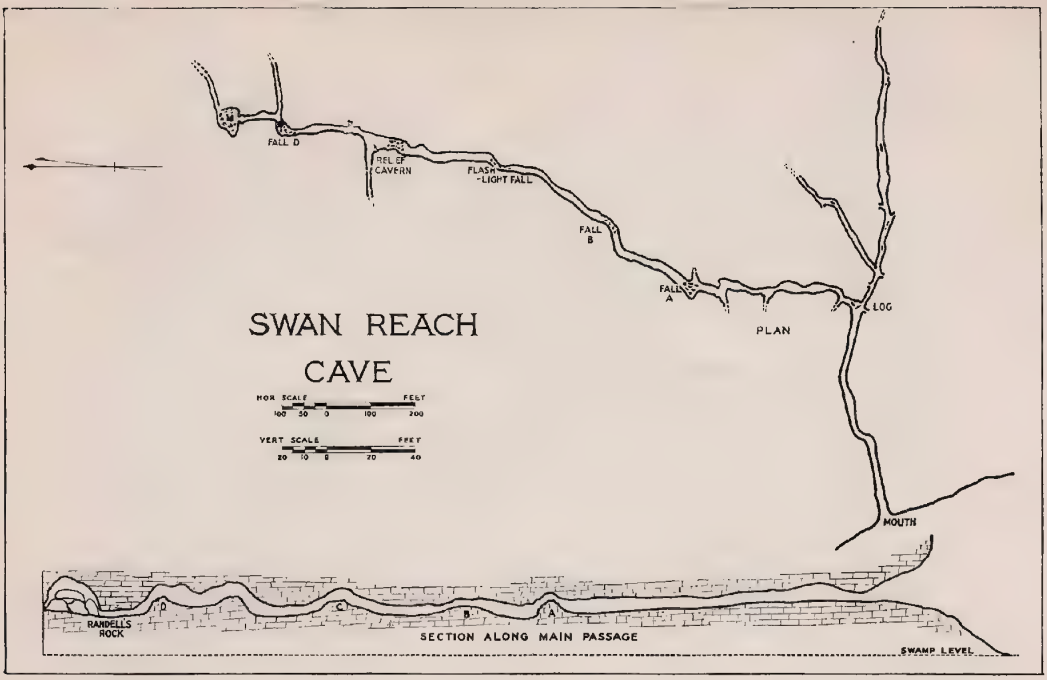
The cave is situated in the cliffs of the left bank of the river about three miles downstream from Swan Reach. At this point the present course of the river does not lie directly against the cliff, but is separated from it by a low levee bank and a wide swamp area. The right bank slopes directly up to the plateau. The stream is at present cutting into its left bank which, although reinforced by red gums and boxwoods, is apparently receding. The levee serves to separate the river from the swamp which lies behind it and runs well up under the cliffs. The swamp is supplied with a running stream of water by a break in the levee near the township, the outlet being about a mile downstream from the cave.

The cave entrance looks out over this lagoon and was twenty-five feet above water level at the time of the investigation.

The fossiliferous marine Miocene limestone beds exposed in the cliff are extremely soft and porous and are much broken and pitted by atmospheric weathering. The cliffs are about one hundred feet in height and the cave mouth which has been considerably enlarged by weathering reaches from thirty-five to forty feet above its floor. This lofty roof quickly slopes down and at about fifteen yards from the mouth is only four feet above the floor. Thereafter the roof varies in height from a maximum of about ten feet to three or four feet as a minimum in the main passages. Small falls of roof material are frequent. At about the twenty-yard mark a tree trunk is to be seen lying longitudinally

View looking east across the swamp towards the cave mouth, which can be seen in the middle distance.

A. F. Pilgrim—Photo.

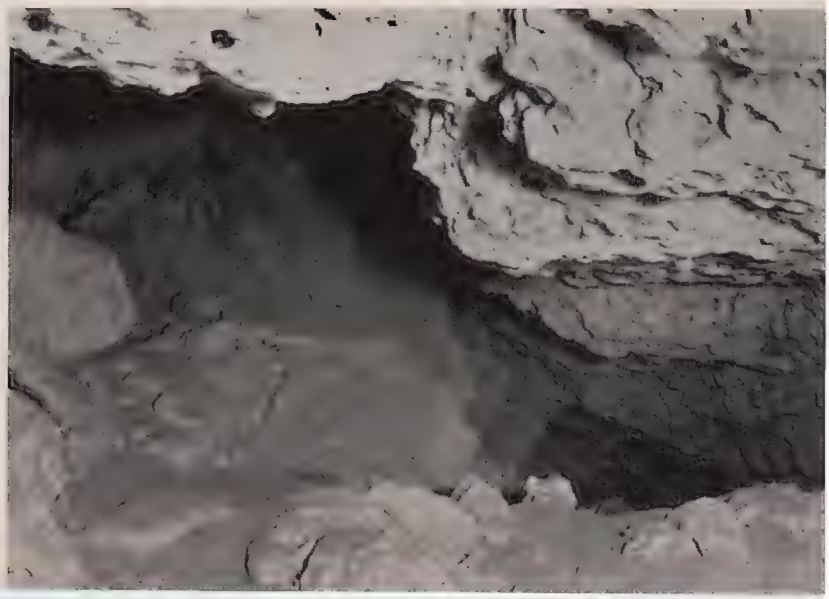


along the passage, and another rather larger one lies about two hundred yards from the mouth. Up to this latter point the general trend of the cave is east, i.e., almost perpendicular to the cliff face, but at the second tree trunk the first main forking takes place. It was thought that the main passage probably continued east, and the exploration of this was undertaken by a small party while another party took the left-hand fork.

The east-running passage proved unproductive, as the walls closed rapidly and roof falls were frequently met. Finally the party was forced to crawl on hands and knees before it was abandoned some two hundred and thirty yards from the log. A minor left-hand branch shown on the plan was followed until it narrowed so that it was almost impossible to turn around in it.

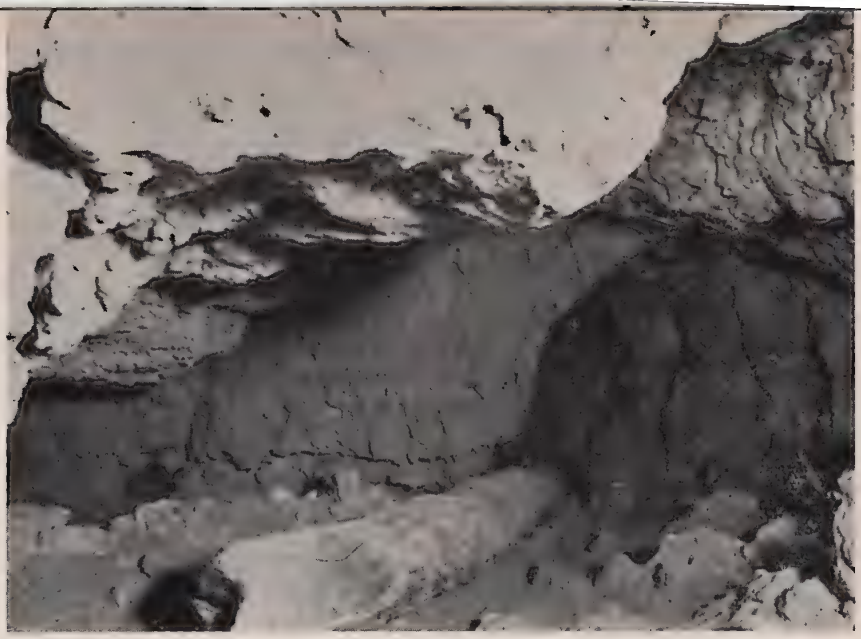
Meanwhile the party on the other branch had been more successful and had followed it for over six hundred yards. This then is the main passage and is the one shown in section in the accompanying diagram.

The main passage trends meridionally from the second log and works its way by a series of rectangular bends, frequently opening out into large caverns and then closing down to



One of the many roof falls encountered in the main passage. Some of these falls could only be negotiated with some difficulty.

A. F. Pilgrim—Photo.



The second log at the forking of the passages. The main passage leaves at the left-hand corner of the photograph. A. F. Pilgrim—Photo.

narrow openings. Several minor passages branch off; all were too narrow to follow for any distance, but were noted to be running at right angles to the main passage.

Finally, about six hundred yards from the log junction, a tremendous fall was found to have terminated the passage which up to this point had been continuing as strongly as ever. This fall became known as Randell's Rock because a certain R. E. Randell had carved his name on it in 1881. The carving is on the fracture face and places an upper time limit to the age of the fall.

With a great deal of effort, members of the party managed to squeeze their way up under the domed roof left by the fall, but were able to find only a very narrow and rapidly closing passage leading out of it.

As has been remarked, the cave limestone is extremely porous, and one of the striking features of the cave is the roughness and irregularity of the walls and roof, which are ramified with circular holes and passages, some of which doubtless reach the surface above. The air supply was always good, draughts were frequently detected though of variable trend. Probably the flow of air is through cracks and solution passages which reach to the surface.

The roof and walls are very damp and in the innermost parts of the cave were decidedly wet. The air near the end of the main passage was saturated with moisture, and, although the temperature was only 72 F., the humidity made conditions unpleasant.

No stalactitic growths were observed, the high humidity preventing evaporation and precipitation.

The floor near the mouth, and to a diminishing extent for five or six hundred yards, is covered by an extremely fine argillacious cave earth which is obviously the insoluble residue from the leaching of the cave rock.

Heaps of bat guano are plentiful, usually below some roof cavity on the edge of which the marks of bat claws could be seen. None of the guano was observed to be fresh and apparently, since none were seen, the bats have vacated the cave for a considerable time.

The soft cave earth for the first five hundred feet was considerably marked by the tracks of beetles, two or three of which were captured.

Excavations were carried out in the cave mouth for human remains and artifacs. F. J. Fenner reports: ". . . there was evidence of aboriginal occupation in the shape of a 9-inch thick band of ash containing shell fragments, occasional quartz chips, etc. No remains of any particular interest were found."

The survey was carried out using a Miner's Dial and cloth tape in the main passage and with a Brunton for the subsidiary passages.

A light 4-inch theodolite was used for levelling, but the methods were more novel than accurate, the irregularity in height preventing the adoption of ordinary practice. The levelling showed that the inner end of the cave was rather lower than the mouth.

The cave is a normal solution type and there are many other smaller ones in these soluble cliffs. Swan Reach has a 10-inch mean annual rainfall and the infrequent showers disappear very rapidly into the ground. The water table, on account of the porosity of the beds, would be near swamp level for a considerable distance back from the cliff face, and meteoric water has hence a hundred feet or so of rock to traverse before reaching it. In the present case, solution has been aided by the presence of rectangular jointing, a feature which is at once indicated by the accompanying plan.

The present cave mouth is occasionally reached by river flood levels, and these infrequent scourings have doubtless played an important part in the enlargement of the cave. The influence of flood waters is shown by the presence of the two tree trunks, the larger of which is 12 inches to 18 inches in diameter, and 20 feet in length. This had penetrated past numerous constrictions and sharp bends for a distance of five hundred and fifty feet.

While the examination of the cave resulted in no spectacular finds, some of the negative results are significant. The party felt some satisfaction in being able to allay the highly exaggerated local and published accounts which had led to the belief that the cave was anything from five to five hundred miles in extent and contained running streams and growing forests.

Randell's Rock is the practical limit of exploration, and no one has been beyond it for sixty years at least.

The thanks of the members of the expedition are due to Dr. Madigan for his work in organisation and leadership. The writer in particular is indebted to him for criticism and advice in the preparation of this paper.

The accompanying plan and section was prepared from material supplied by the surveyors of the party, Messrs. Aitchison and Nairne.

View taken in the cave mouth showing the excavation in the foreground.

A. F. Pilgrim—Photo.

The Myrtle Plant Family

SOUTH AUSTRALIAN SPECIES OF THE ORDER MYRTACEAE.

By ERNEST H. ISING.

A very large order extremely abundant in South America and Australia; less common in Asia, very thinly scattered over Africa, chiefly tropical and a few species in the temperate zones. In 1926 Fawcett and Rendle (Flora of Jamaica IV, 313) recorded about 2,750 species grouped into about 60 genera. Ewart (Flora of Victoria 793) in 1930 gave a total of 3,000 species in 80 genera, but he evidently included the Lecythidaceae, which is now considered to be a separate family. Out of the 60 genera 29 occur outside Australia and 31 are endemic here; 12 of the first group are partly Australian and partly exotic. The largest Australian genus is *Eucalyptus*, but there are larger genera outside this country, as the following list will show:—

Myrcia: 500 species; tropical America.
Eugenia: 600 to 700 species according to various authorities; tropical America; Asia; Australia; Africa; Philippine Islands (about 200 species).

Other large genera are as follows:—
Psidium: 120 species; tropical America.
Melaleuca: 110 species; mostly Australian; also in New Caledonia and Malay Archipelago.

Myrtus: 100 species; Australia; Europe; Western Asia; America and Africa.
Calyptranthes: 70 species; tropical America.

West Australia has a remarkable number of endemic genera, for out of a total of 32 genera in that State 15 or nearly 50% do not occur in any other State or in the world. The 15 genera have a total of 104 species. Besides this there are 10 genera which find their chief expression in the western part of this continent. The following list gives the number of species in each genus in Australia, followed by the number in West Australia:—

Darwinia	37	—	27
Verticordia	40	—	37
Calythrix	40	—	37
Lhotzkya	10	—	7
Thryptomene	40	—	21
Micromyrtus	15	—	12
Baeckea	57	—	46
Agonis	12	—	11
Kunzea	20	—	11
Melaleuca	110	—	94

1. BAECKEA L.

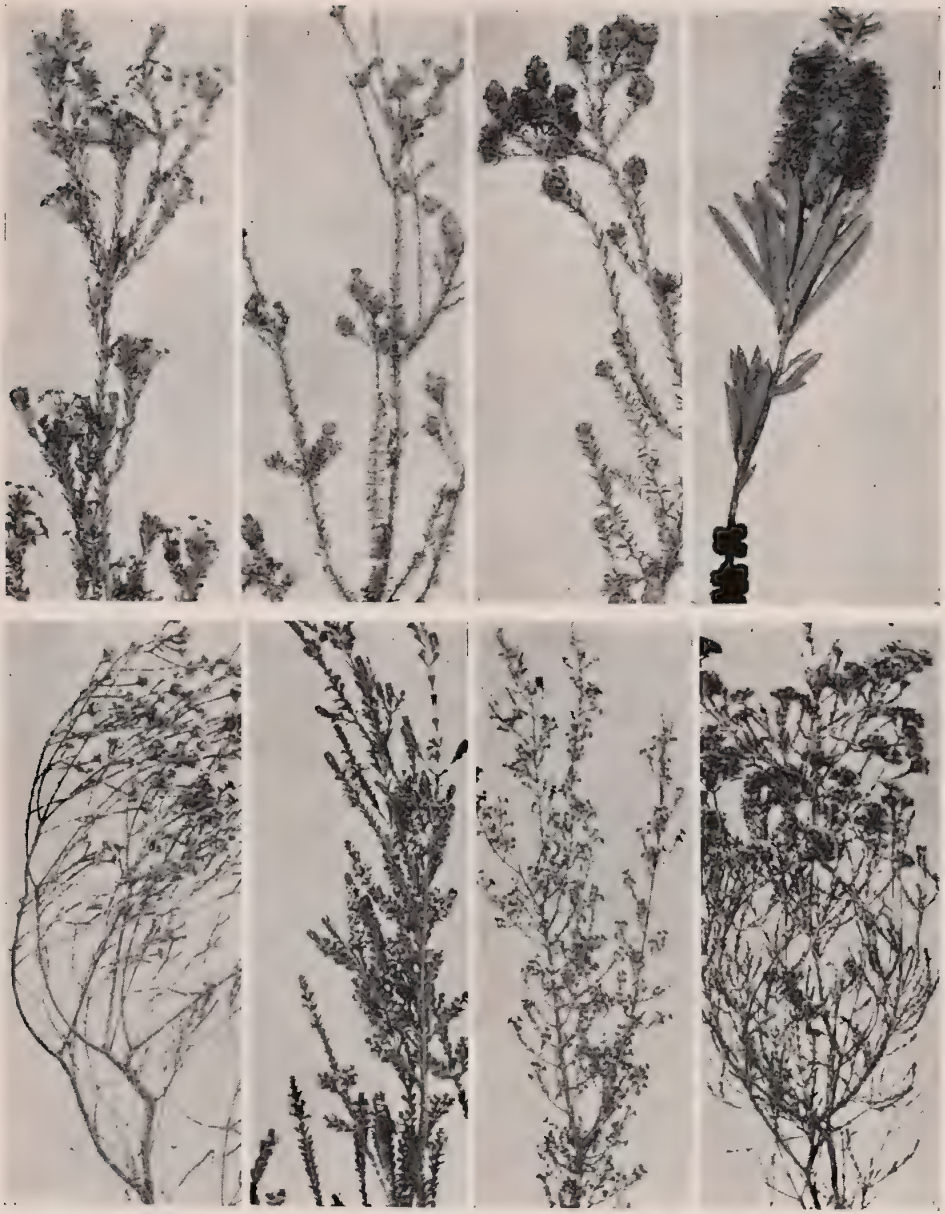
The great majority of the 57 species known in this genus are found in West Australia, four only are found in this State. Three of these are distributed in the Mount Lofty Range, Kangaroo Island has two of them, while in the Murray Scrub three find a home and two are located west of St. Vincent Gulf. *B. Behrii* is used for making brush fences and is a good garden shrub. It has numerous erect branches, bright green leaves, and white flowers. The other species are smaller plants with handsome small pink flowers. *B. crassifolia* is a fine sight in the spring in the Murray lands.

2. LEPTOSPERMUM Forst. f.

About 30 species are known in this genus, mostly Australian, with four as South Australia's share. The tea-tree *(L. coriaceum)* having preference for the drier parts of the State, is found in the Murray Lands, Yorke and Eyre Peninsulas. The other three species prefer the wetter parts, viz., Mount Lofty Range, Kangaroo Island, and the South-East. One of them *(L. pubescens*, the silky tea-tree) is almost solely found in the creeks and swamps. The flowers of our species are white and are certainly decorative.

3. KUNZEA Reichb.

Only one representative, out of 20 in Australia, is native of this State, and it is found chiefly along the sandy coasts and sandy areas in the east and south-east. The plants are of a prostrate habit and produce long runners rooting at the nodes and is a valuable species in checking sand drift. The perfume of the white flowers is of a strong and unpleasant nature. *K. pomifera* has a succulent fruit known as "muntry," and is our only local species.



UPPER ROW.

Calythrix involucrata J. M. Black. Waddike Rock, E.P., 2/9/35.
Lhotzkya alpestris (Lindl.) Druce. Near Custon, 18/10/34.
Melaleuca squamea Labill. var. *glabra* Cheel. The Springs, near Mt. Gambier, 21/10/34.
Callistemon rugulosus D.C. Naracoorte, 27/11/33, Mrs. V. Petherick.

LOWER ROW.

Micromyrtus ciliata (Sm.) Druce. Near Custon, 18/10/34.
Thryptomene Miqueliana F.v.M. Arno Bay, 28/8/35.
Baeckea crassifolia Lindl. Monarto South, 1/9/37.
Darwinia micropetala (F.v.M.) Benth. Lucindale, 29/10/34.

4. CALLISTEMON R. Br.

There are 12 or more species of this genus in our continent, with four to be found within our borders. They are all shrubs and vary from 5 to 12 feet in height and are known by the very appropriate vernacular of "bottlebrush." Three of the species have scarlet or purplish flowers and are of a very decorative nature, the most handsome one is perhaps *C. rugulosus,* which grows a. its best in areas of medium rainfall. One species *(C. salignus)* is confined to wetter situations such as creeks and gullies in the Mount Lofty and Barossa Ranges. *C. teretifolius* is only to be found in the Flinders Range, and *C. brachyandrus* in the Murray Lands. This genus produces some good garden shrubs; the leaves as well as the flowers are very showy, particularly in the young stages.

5. MELALEUCA L.

These "tea-trees" form the second largest group in the Myrtaceae, there being over 100 known species, practically all of which are Australian. Our State can only record 15, while almost the whole number are found in West Australia. Shrubs and trees are the habits of this genus, which is spread over nearly the whole of the State. It is curious to note that there are more species on Kangaroo Island than in the Mount Lofty Range; some are in the Mallee areas and one or two in drier parts of our Far North. Many of the species are good flowering shrubs, the color of the filaments being either white, red, pink or purple; some of them have a white papery bark.

6. EUCALYPTUS L'Heriter.

The genus Eucalyptus is widely spread throughout all the States and is almost confined to the Australian continent. According to Blakely (1934) there are three well-defined species that occur outside Australia. They are *E. alba, E. Schlechteri,* and *E. deglupta,* which also do not find a home here, while three species of our continent are also native to Papua *(E. clavigera, E. papuana,* and *E. umbellata). E. alba* also grows in Timor and Java, and *E. deglupta* is found in the Philippine Islands, New Britain, and New Ireland. E. D. Merrill (1923) says of *E. deglupta* that it "grows on the Island of Mindanao (Philippine group) to Celebes. Growing in primary forests in well-drained places along streams, from sea level to 600 metres altitude; one of the largest trees in the Archipelago; Celebes, Moluccas, New Guinea and Bismarck Archipelago."

This genus has always been a very difficult one to differentiate, and from 134 species known in 1866 (Flora Australiensis, III, 185) it has grown to 470 described species in 1934 (Blakely, Key to the Genus Eucalyptus). Other botanists have been more cautious, for Black gives 200 species in his Flora of South Australia (1926), Ewart (Flora of Victoria, 1931) quotes the same number, and Petrie (Linn. Soc. N.S.W. L., 1925, 146) gives 300. The late J. H. Maiden's work, "A Critical Revision of the Genus Eucalyptus," was not completed at the time of his death in 1927, but he had revised over 300 species. There is no doubt that there will be many more species described as further exploring is done in the north and north-west of Australia.

This is one of the remarkable genera in Australia, for Petrie (l.c.) says:—"The Eucalyptus forest, the chief expression of the Australia endemic flora, is perhaps one of the most extensive plant formations in the world, and occupies the greater parts of Australia . . . Many of the features of these forests are unique. With few exceptions the association dominants are species of Eucalyptus, and the fact that there are about 300 species in Australia gives some idea of the peculiar complexity of the formation. The foliage is small in amount for the size of the trees. The trees are seldom close enough for their crowns to meet, and in any case the open nature of their foliage results in little obstruction to the penetration of light to the ground."

In our State the genus may be divided into two groups, as follows:—

I. Trees with a large main trunk;

II. Several stems growing from the same root-stock, known as mallee.

Group A. Trees varying in size, some being 10 feet to others over 100 feet. They grow in all climates, soils and habitats from the coastal plains to the highest mountains and extend to the far northern interior.

Group B. The Mallees are confined to a dry habitat with an annual fainfall of from 8 to 15 inches and are often found in sandy soil.

Only Tasmania has a lesser number of species than this State; our total is 47. Various characters have been used for their classification, viz., the bark, the anthers, and the

fruits. Using the cortical system we have the following groups:—

I. Smooth bark, 13 species.
II. Stringybark, 3 species.
III. Flaky bark, 4 species.
IV. Rough bark, 6 species.
V. Mallees, 21 species.

The anthers shed their pollen in two ways, either by means of pores or by long cells which split open, and, coupled with the various shapes of the anthers, they form a very useful primary division for a key of identification. The fruits are grouped according to their shape, and this character has been made use of by a number of workers.

It has a wide economic value, producing timber of great strength and durability; the flowers secrete nectar and the leaves give medicinal and other oils of wonderful usefulness.

The flowers are mostly white and are borne often in large masses; only one or two of our species have reddish flowers. The leaves hang vertically so that their surfaces are not presented to the heat of the noonday sun, and they are thus enabled to retain more moisture and withstand our dry, hot summers. The leaves of the seedling plants are always of a different shape to the mature ones.

7. DARWINIA Rudge.

In this genus there are about 40 species in Australia, South Australia only possessing two. The plants in our State are small shrubs of about one foot and having a densely branched system with small leaves and small white flowers. The habitat is usually one of flooded flats and sandy soil. One species occurs in the south-east in dense formation *(D. micropetala);* it is also found on Eyre Peninsula, where also the second one is to be seen.

The style in our two species has a growth of hairs near the summit and is exserted from the flowers.

8. HOMORANTHUS A. Cunn.

There appears to be only two species in Australia; one occurs in New South Wales and Queensland, and a different one occurs in this State. It was previously united with Verticordia, but was separated from that genus on account of the subulate, entire calyx lobes of the former, and the deeply divided subulate, plumose or hair-like lobes of the latter.

A. Erect shrub, leaves narrow, flowers white, sepals with a fringe of hairs.
1. *H. Wilhelmii.*

9. MICROMYRTUS Benth.

A genus endemic in Australia and containing about 15 species, only two of which are native to this State. *M. flaviflora* is only to be found in our far north-west country, while *M. ciliata* is in the opposite side of the State at Pinnaroo and the Ninety-Mile Desert. Both are small shrubs, the former having yellow flowers and the latter pink.

10. THRYPTOMENE Endl.

About 40 species are known in Australia, but no more than four are found in South Australia. The distribution is chiefly in the mallee areas, where they do well and grow fairly extensively. They form shrubs of 2 to 3 feet, which bear many branches and become beautiful plants when in flower.

This is one of the very best plants for garden culture, as the shrubs are from 3 feet in height and bear masses of white or pink flowers.

11. CALYTHRIX Labill.

Out of about 40 Australian species we have in this State only two, and they are shrubs of 2 to 3 feet in height. The most common one *(C. tetragona)* is widely distributed over our State in the better rainfall areas; it is common in our hills and in the Mount Lofty Range in general, and extends also to the mallee areas. This species has been divided into a number of forms which have been given specific names, but, although it is diversified in its leaves and clothing, it is only considered to be one good species. The second species *(C. involucrata)* is chiefly confined to Eyre Peninsula, although one occurrence has been recorded at Kangaroo Flat.

The flowers are white and sometimes shading to pink, and are decidedly decorative as they develop in heads at the end of the branches. West Australian species have rich yellow, purple flowers, and other showy shades.

12. LHOTZKYA Schauer.

There are 10 species in our continent, and South Australia's share is three. They are shrubs of 2 to 3 feet and are very similar to *Calythrix*, and the chief difference is that the calyx in the latter is produced into fine hairs at the tip, while they are wanting in *Lhotzkya.* The distribution is as follows:—Encounter Bay, Kangaroo Is., and South-East.

The white flowers and fine foliage make the plants attractive and form good garden shrubs.

KEY TO THE SOUTH AUSTRALIAN GENERA.

Tribe *LEPTOSPERMEAE.*

A. Fruit a 3-10 celled capsule; placentas axile.
Baeckea 1; *Leptospermum* 2; *Kunzea* 3 (capsule succulent); *Callistemon* 4; *Melaleuca* 5; *Eucalyptus* 6.

B. Flowers solitary, sessile or subsessile in the the axils of the leaves or bracts; petals free, orbicular, shrubs. 1, 2, 3, 4 and 5.

C. Stamens not exceeding the petals; anthers with a terminal gland.

D. Leaves opposite; anthers opening by slits or pores 1

DD. Leaves alternate; anthers opening by slits 2

CC. Stamens longer than petals; anthers dorsifixed; opening by parallel slits.

E. Stamens all free.

F. Sepals persistent, flowers in heads 3

FF. Sepals deciduous, flowers in spikes 4

EE. Stamens connate in 5 bundles opposite the petals 5

BB. Flowers in mostly axillary umbels; sepals and petals united in the shape of a cap; chiefly trees 6

Tribe *CHAMAELAUCIEAE.*

AA. Fruit 1-celled, indehiscent, nut-like, placenta lateral or rarely basal; mostly slender, heath-like shrubs.
Darwinia 7; *Homoranthus* 8; *Micromyrtus* 9; *Thryptomene* 10; *Calythrix* 11; *Lhotzkya* 12.

B. Style bearded towards summit; stamens 10, in 1 row, alternating with as many staminodes; receptacle cylindrical; petals ovate, white; anthers globular, opening in pores, leaves opposite. 7 and 8.

C. Sepals entire 7

CC. Sepals with 1-6 long hairs at summit 8

BB. Style glabrous; ovary with a broad or narrow layer of rather loose tissue between its outer wall and its inner one, which enclose the ovules. 9, 10, 11 and 12.

D. Stamens 5, without staminodes; anther cells distinct, almost globular, opening by short often divergent slits; petals orbicular; receptacle more or less cup-shaped.

E. Stamens opposite petals 9

EE. Stamens alternate with petals . 10

DD. Stamens about 20, in several rows; anthers opening by parallel slits; petals oblong.

F. Sepals ending in a long bristle or awn; receptacle fusiform, beaked 11

FF. Sepals obtuse, awnless; receptacle almost obconical 12

KEYS TO SPECIES.

BAECKEA L.

A. Small shrubs, about 2 feet or under.
B. Stamens 10, flowers stalked.
C. Leaves flat, plant diffuse. 1. *B. ramosissima.*
CC. Leaves roundish, plant erect. 2. *B. crassifolia.*
BB. Stamens 15, flowers sessile. 3. *B. ericaea.*
AA. Tall shrub, mostly about 5 feet, branches erect slender. 4. *B. Behrii*—Broombush.

LEPTOSPERMUM Forst. f.

A. Tall shrub, about 12 feet, usually growing in fresh water creeks, leaves grey and silky. Silky tea-tree. 1. *L. pubescens.*
AA. Shrubs about 5 feet.
B. Leaves prickly, seed pods persistent. 2. *L. scoparium.*
BB. Leaves blunt.
C. Pods not hairy, green. 3. *L. coriaceum.*
CC. Pods silky, falling off in the first year. 4. *L. myrsinoides.*

CALLISTEMON R. Br.

A. Leaves flat, lanceolate.
B. Flowers crimson, spikes large. Scarlet bottle-brush. 1. *C. rugulosus.*
BB. Flowers cream, spikes small, shrub growing chiefly in creeks. 2. *C. salignus.*

AA. Leaves needle-like, flowers reddish.
C. Flower spikes 2 to 3 inches long. 3. *C. teretifolius.*
CC. Flower spikes about 1½ inches long. 4. *C. brachyandrus.*

MELALEUCA L.

A. Leaves generally opposite.
B. Flowers red, pink or purple.
C. Fruit rachis not swollen. 1. *M. Wilsonii.*
CC. Fruit rachis swollen.
D. Leaves oval, usually under ¼ inch. 2. *M. gibbosa.*
DD. Leaves oblanceolate, about ½ inch. 3. *M. decussata.*

BB. Flowers whitish.
E. Leaves with short stalk.
F. Leaves 5-7 nerved, ovate. 4. *M. squarrosa.*
FF. Leaves nerveless.
G. Flowers in axillary clusters; shrubs. 5. *M. acuminata.*
GG. Flowers in terminal heads; trees. 6. *M. halmaturorum.*
EE. Leaves without stalks. 7. *M. quadrifaria.*

AA. Leaves usually alternate.
H. Flowers purple. 8. *M. squamea.*
HH. Flowers whitish.
I. Leaves flat narrow; flowers in spikes.
J. Leaves under ½ in. long. 9. *M. pubescens.*
JJ. Leaves ½ to 2 inches long. 10. *M. linophylla.*

II. Leaves needle-like or flattened; flowers not in spikes.
K. Leaves ½ to 2 inches long; flowers in heads.
L. Leaves with straight points. 11. *M. glomerata.*
LL. Leaves with curved points. 12. *M. uncinata.*
KK. Leaves less than ½ inch long, blunt.
M. Flowers in axillary or side clusters. 13. *M. fasciculiflora.*
MM. Flowers in terminal heads. 14. *M. pauperiflora.*

EUCALYPTUS L'Heriter.

I. SMOOTH BARKS.

A. Stamens in 4 bundles. 1. *E. eudesmioides.*

AA. Stamens in a complete ring.
B. Fruits ¾ to over 1 inch long, urn-shaped.
C. Fruits about ¾ inch, smooth, thin-skinned; top layer of bark thin, ashy coloured. Only found in Far North. 2. *E. dichromophloia.*
CC. Fruits 1 inch long or more; bark snow white. 3. *E. terminalis.*
BB. Fruits less than ¾ inch long.
D. Cap with a point or beak.
E. Beak about ¼ inch long, fruit cup-shaped, about ½ inch long. S.A. Blue Gum. 4. *E. leucoxylon.*
EE. Beak about ⅛ inch long, fruit less than ¼ inch long, convex on top, valves protruding. S.A. Red Gum. 5. *E. camaldulensis* (E. rostrata).
DD. Cap blunt or slightly pointed.
F. Flower base 2 or 3 times as long as cap.
G. Fruit urn-shaped. Sugar Gum. *E. cladocalyx.*
GG. Fruit ovoid. Only found in the South-East. *E. pauciflora.*
FF. Flower base about as long as cap.
H. Fruit broader than long.
I. Fruit about ½ inch long and ¾ inch wide, base rounded, cap hemispherical. 8. *E. cosmophylla.*
II. Fruit ¼ inch long, base rounded, cap conical. 9. *E. conglobata.*
HH. Fruit about as wide as long.
J. Fruit pear-shaped and like a cup. 10. *E. intertexta.*
JJ. Fruit convex on top, valves protruding.
K. Fruit base wide; bark usually very white; seedling leaves orbicular. 11. *E. rubida.*
KK. Fruit base rounded or ovoid.
L. Flowers in 3's. 12. *E. viminalis.*
LL. Flowers usually more than 3 and up to 10. 13. *E. Huberiana.*

II. STRINGYBARKS.

A. Small tree about 20 ft.; fruits ovoid or pear-shaped. 1. *E. vitrea.*
AA. Large trees about 100 ft.
B. Fruit cup-shaped; crown of tree open. 2. *E. obliqua.*
BB. Fruit convex on top; crown of tree dense, umbrella-like. 3. *E. Baxteri.*

III. FLAKY BARKS.

A. Bark dark and rough.
B. Leaves usually ovate lanceolate to 2 inches wide; fruit broad obconical, valves level with top. 1. *E. ovata.*
BB. Leaves lanceolate about 1 inch wide or less; fruit ovoid, valves deeply sunk. 2. *E. odorata.*

AA. Bark pale and smooth.
C. Leaves drying pale; cap hemispherical; fruit over 1 inch long, ovoid; only found in Far North East. 3. *E. pyrophora.*
CC. Leaves dark green; cap conical; fruit about ¾ inch or more long, pear-shaped. 4. *E. fasciculosa.*

IV. ROUGH BARKS.

A. Flowers red. Only found on Eyre Peninsula. 1. *E. Landsdowneana.*
AA. Flowers white.
B. Leaves whitish; fruit oblong about ½ inch long. 2. *E. albens.*
BB. Leaves green.
C. Base of flower 3 times as long as cap; fruit under ¾ inch long; large tree growing chiefly along River Murray. 3. *E. largiflorens.*
CC. Base of flower about as long as cap.
D. Umbel stalk flattened. 4. *E. elaeophora.*
DD. Umbel stalk round.
E. Fruit depressed globular, about ¾ inch dia. Only found in Far North. 5. *E. microtheca.*
EE. Fruit ovoid, about ¼ inch long. Only found in Mt. Remarkable district. 6. *E. microcarpa.*

V. MALLEES.

A. Leaves in pairs, some of which are joined round the stem. 1. *E. gamophylla.*
AA. Leaves alternate.
B. Fruits about 1½ inches long and 2½ inches dia., convex on top, ribbed at base. 2. *E. pyriformis.*
BB. Fruits 1 inch or less long.
C. Fruits ¾ inch long.
D. Fruits 1 inch wide, convex on top and ribbed at base. 3. *E. pachyphylla.*
DD. Fruits ¾ inch wide, pear-shaped. 4. *E. pimpiniana.*
CC. Fruits under ¾ inch long.
E. Fruits flat-topped, cap conical. 5. *E. diversifolia.*

EE. Fruits with valves included or exserted.
F. Valves included or sunk in fruit.
G. Cap conical.
H. Fruit ribbed or angled. 6. *E. calycogona.*
HH. Fruit not ribbed.
I. Leaves broad lanceolate, thick, about ¾ inch wide. 7. *E. incrassata.*
II. Leaves narrow, about ¼ inch wide. 8. *E. leptophylla.*
GG. Cap hemispherical.
J. Leaves with black dots.
K. Fruits over ½ inch long. 9. *E. angulosa.*
KK. Fruits about ¼ inch long. 10. *E. gracilis.*
JJ. Leaves without black dots.
L. Leaves shining; fruits about ¼ inch long, ovoid. 11. *E. Behriana.*
LL. Leaves dull; fruit over ¼ inch long, wide at base. 12. *E. dumosa.*
FF. Valves exserted from fruit.
M. Cap conical, beaked.
N. Cap twice as long as flower base. 13. *E. Oldfieldii.*
NN. Cap as long as flower base.
O. Leaves whitish, also the whole plant. 14. *E. Gillii*
OO. Leaves green.
P. Fruit globular; valve points long and protruding. 15. *E. oleosa.*
PP. Fruit urn-shaped. 16. *E. Flocktoniae.*
MM. Cap hemispherical.
Q. Leaves yellowish. 17. *E. ochrophylla.*
QQ. Leaves green.
R. Fruit about ½ inch long, convex on top. 18. *E. Ewartiana.*
RR. Fruit about ¼ inch long.
S. Cap ribbed. 19. *E. brachycalyx.*
SS. Cap not ribbed.
T. Fruits in dense globular clusters; narrow-leaf mallee of Kangaroo Island. 20. *E. cneorifolia.*
TT. Fruits in clusters of 2-7; only found in Flinders Range. 21. *E. Morrisii.*

DARWINIA Rudge.

A. Leaves narrow, about ¾ inch long, erect shrub, flowers erect. 1. *D. micropetala.*
AA. Leaves narrow, about ¾ inch long, prostrate shrub, flowers drooping. 2. *D. homoranthoides.*

MICROMYRTUS Benth.

A. Flowers yellow, few near the tops of the branches. 1. *M. flaviflora.*
AA. Flowers pink, clustered near the tops of the branches. 2. *M. ciliata.*

THRYPTOMENE Endl.

A. Base of flower not or faintly ribbed, petals longer than sepals.
B. Flower base wrinkled. 1. *Th. Maisoneuvii.*
BB. Flower base smooth. 2. *Th. Elliottii.*
AA. Base of flower 10-ribbed.
C. Leaves very narrow. 3. *Th. ericaea.*
CC. Leaves obovate. 1. *Th. Miqueliana.*

CALYTHRIX Labill.

A. Flowers solitary in upper axils, forming leafy heads. 1. *C. tetragona.*
AA. Flowers usually in a cluster surrounded by transparent bracts at base. 2. *C. involucrata.*

LHOTZKYA Schauer.

A. Plants devoid of hairs. 1. *L. glaberrima.*
AA. Plants hairy, but not densely so.
B. Sepals orbicular. 2. *L. alpestris.*
BB. Sepals cut off across the top. Only found on Kangaroo Island. 3. *L. Smeatoniana.*

Note.—Some of these keys have been adapted from the "Flora of South Australia" by J. M. Black.

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How The Woma
(ASPIDITES RAMSAYI)
Carries Its Eggs

By E. A. T. Vogelsang.

Some years ago while at the Killalpaninna Mission Station on Cooper's Creek, I saw a strange example of how the large carpet snake, the Woma *(Aspidites ramsayi)*, took care of its eggs. Early one morning, in company with a blackboy, I was looking for cattle tracks, when suddenly I noticed an extra wide snake track. I remarked to the blackboy that it must have been a very large snake, but he said it was only the usual track of the Woma carrying away her eggs.

We left our horses and followed the track on foot. After proceeding for about half a mile we caught up with the snake. As soon as it saw us it stopped quite still. The body of the snake was coiled around twice and had eleven eggs on the coil, while the snake pushed itself along with the remaining portion of the body, which was about twelve inches long. During progression the Woma crawled along steadily and carefully.

I was sorry I did not have my camera with me to take a photograph of this unusual spectacle.

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SHARKS.

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EXCURSIONS.

1939.

April 22—Glenelg. Tram, 1.30 p.m. Intertidal Life. Mr. B. C. Cotton.

April 29—Blackwood. Train, 1.14 p.m. Cultivated Flora. Mr. Edwin Ashby.

May 13—57 Pulsford Road, Prospect. Tram, 2 p.m. Timbers. Mr. A. J. Wiley.

May 20—Semaphore to Largs. Train, 1.10 p.m. Shells. Mr. A. K. Beasley.

May 27—National Park, Victoria Drive. Train, 1.14 p.m. Botany. Miss C. Eardley.

June 12—Monarto South. Train, 7.55 a.m. Birds. Mr. W. D. Wade.

June 17—63 Barker Road, Prospect. Tram, 2 p.m. Corals. Mrs. F. Cordon.

June 24—Outer Harbor South. Train, 1.10 p.m. Echinoderms. Mr. F. K. Godfrey.

July 1—Museum. 2 p.m. New Additions. Mr. H. Hale.

July 8—Largs North. Train, 1.10 p.m. Foraminifera. Mr. R. C. Shinkfield.

July 22—Waterfull Gully Reserve. Motor, 1.45 p.m. Fungi. Professor J. B. Cleland.

August 5—Belair. Train, 1.14 p.m. Orchids. Mr. H. Goldsack.

August 19—Brighton. Train, 1.11 p.m. Marine Invertebrates. Mr. B. C. Cotton.

August 26—National Park. Train, 1.14 p.m. Parasites. Mr. E. H. Ising.

EVENING MEETINGS.

April 18—"Western Australian Wild Flowers," Mrs. L. A. Greaves.

May 16—Shell Club Evening, Mr. B. C. Cotton, Chairman.

June 20—"Across the Continent and Back in Two Days," Mr. S. R. Harry.

July 18—"The Koonamore Vegetation Reserve," Professor J. G. Wood.

August 15—Annual Meeting.

Members are requested to bring exhibits whenever possible.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Bookings close with the Secretary or Treasurer three days before excursion, and seats will be allotted in order of priority.

SHARKS.

(By F. W. Moorhouse, M.Sc.)

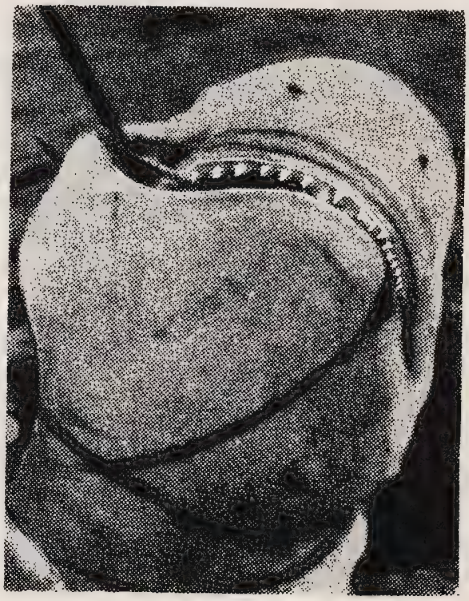
The word "shark" has a strange fascination over most of us, the very sound causing many to shudder. But there are those amongst us who think of sharks as those animals which are more profitable than pigs, others think of them as an excellent sporting fish, some again as a food. A writer of a popular article in a South Australian magazine of recent date, however, is the first to tell us that sharks are not fish.

In recent years much publicity has been given to sharks by game fishermen, and some very fine literature is now available, for instance, Messrs Norman and Fraser in their "Giant Fishes, Whales and Dolphins" have supplied a most entertaining article along these lines.

It is interesting to report that in general no publicity has been given to sharks in this State because of their attacks on bathers. Such attacks are almost entirely unknown—in fact, only one instance is on record. They are helping to advertise this State as an important game fishing centre. A world record White Pointer weighing 1,291 lb. was recently captured off Port Lincoln. There is, amongst game fishermen, a very great desire to bring to gaff a record fish on a particular type of thread. The game fisherman who desires mainly the thrilling sport of landing a fighter has found that more often than not it is the smaller shark that gives the most thrilling battle.

In this article it is intended to deal with the more important members of the Selachian section of the sub-class Elasmobranchs. Our one representative of the sub-class Holocephali will also be included. This means that only seventeen of some thirty-six known different sharks found in South Australia will be treated here. Such sharks as the Cat Sharks, the Carpet Sharks, the Angel Sharks, as well as all the Rays, are being omitted.

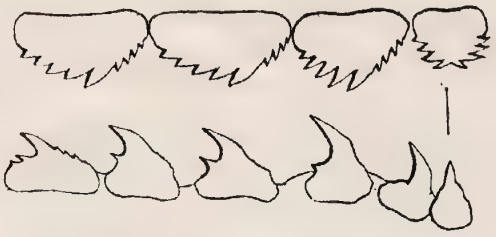
This paper is not intended to displace the excellent publication, "The Fishes of South Australia," by Edgar R. Waite, F.L.S., C.M.Z.S., published by, and obtainable from, the Government Printer for the small sum of 6/; it rather is to supplement that work and to record the heaviest of the shark catches made to date by members of the Game Fishing Club of S.A.; the weights herein mentioned



A large Shark being hauled in after a desperate struggle off Port Lincoln.

have been supplied through the courtesy of Mr. J. Veitch (Official Weight Recorder) and Mr. H. Fairfax Johnson (Hon. Secretary) of that body.

Sharks (and their relatives the Rays) have cartilaginous skeletal structures, i.e., they possess no true bones; their gristly skeletons, especially the "backbone," are, however, frequently strengthened by deposits of lime. If the backbone of a bony fish, for example that of the Tommy Rough, be pictured in the mind it will be recalled that there is a disc-like

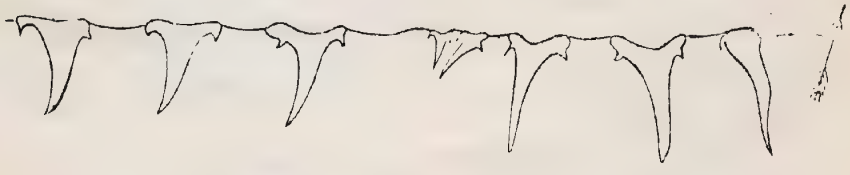


Teeth of Seven-Gilled Shark.

central portion of the vertebra to the top and to the bottom of which a spiny process is attached, these spines giving to the backbone a tooth-comb appearance. The vertebra of the shark on the other hand are merely discs so that the absence of the projecting spines from the vertebra taken from a cutlet of fish served to a diner, in a Melbourne restaurant for instance, is a sure indication that the boneless flesh just partaken of, and thoroughly enjoyed, came from either a Gummy Shark or a Snapper Shark.

Again, sharks do not possess scales. Instead, the skin is dotted with denticles which tooth-enamel. It is interesting to remind ourselves that we also possess, or possessed, modified denticles, but ours are firmly embedded in sockets in the jaw, whereas those of the shark, arranged in tightly packed rows, are simply embedded in the gums. The teeth in these various rows are continually growing towards the forward position so that a shark has a constant supply of new teeth ready to replace those lost or cast off from the one or two foremost rows which are the only rows actually in use.

Most of us, on catching a shark, are anxious to know what species it is and it is felt that,



Teeth of the Grey Nurse (natural size).

like structures give a rough, sand-paper effect, especially noticeable if the hand be drawn along the body towards the head. This rough shagreen was the sand-paper of olden days, and it is used to-day by hat manufacturers for bringing the nap up on felt and velour hats. Suitable skins for this purpose are not common, and are becoming increasingly difficult to obtain.

The teeth of a shark are modified denticles because the structure of the tooth is essentially that of the denticle, i.e., internal pulp cavity, dentine and an outer coating of

though several species have a general common appearance, the tooth structure of most sharks is sufficiently distinctive to allow of ready use in the identification and classification of that fish. The teeth of several species are therefore pictured.

In the preparation of this article the blocks used by Mr. Waite have been loaned by courtesy of the Board of Governors of the Public Library, to whom my thanks are due. Some were prepared by Mr. B. C. Cotton (Conchologist, S.A. Museum), whose assistance has been readily given.

SEVEN-GILLED or GROUND SHARK

(Notorhynchus pectorosus).

Figs. 1 and 2.

This fish is common around Kangaroo Island and attains a length of 8 ft. The teeth are of primitive type and bear many cusps. They differ in the two jaws, as well as in the same jaw. A noticeable feature is the presence of only one dorsal fin.

PORT JACKSON SHARK *(Heterodontus philippi).*

Figs. 3, 4, and 5.

This shark grows to about 4 ft. in length and has external features that characterise it from most other sharks. Black marks on each side of the face and body are outstanding features, so also are its blunt head and its spined dorsal fins. The teeth are similar in formation in both jaws, but they differ very much in the same jaw. Those in the back of the jaw are arranged like crushing plates so as to enable the shark to smash up shell fish, crabs and even sea urchins, upon which it preys. This shark is common around our coasts, and has often been the only fish taken by parties fishing in the neighborhood of the "Norma" wreck.

COCKTAIL or WHALER SHARK

(Carcharhinus brachyurus).

Fig. 6.

One of the most common sharks in South Australian waters: especially is it so in the neighborhood of Kangaroo Island. The heaviest Cocktail (of very many captured by the members of the Game Fishing Club of South Australia) weighed 101 lb. and was captured in 1938 near the Outer Harbor. The sharks are usually bronze colored on the back, and cream bellied, but considerable color variations occur.

BLUE SHARK *(Prionace glaucum).*

Fig. 7.

This shark is named from its intense blue appearance when it is in the water. It is seldom reported from our waters and must not be confounded because of its name with the Blue Pointer, from which it is readily identified. The Blue Shark has no spiracle behind the eyes.

TIGER SHARK *(Galeocerdo arcticus).*

Figs. 8 and 9.

A very vicious shark and considered by many writers to be the most ferocious of all. There are reports of several large ones having been captured in South Australia, but to date no shark thought to belong to this species has been definitely identified as such. A member of the party with Zane Grey recently captured a very large specimen off Sydney Heads. It weighed 1,382 lb., and is a world record. There are many records in the Eastern States of attacks on boats having been made by this species. Its teeth are similar in both jaws and bear a very deep notch on the outer margin. These teeth are frequently used for decorative purposes. A very noticeable feature is the presence of a spiracle behind the eye and of a pit on the upper side of the peduncle or base of tail; no other species of shark, according to Waite, having both these characteristics.

SCHOOL SHARK *(Galeus australis).*

Figs. 10 and 11.

These fish are so called because of their habit of moving about in shoals. They are easily recognised by the teeth, which are small but very sharp. This is one of the commonest sharks of South Australia. They are prolific breeders.

GUMMY SHARK *(Mustelus antarcticus).*

Figs. 12 and 13.

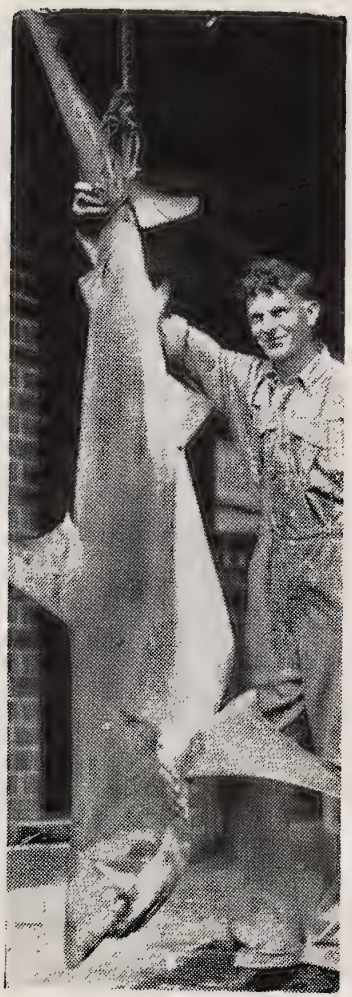
One of the most widely distributed of Australian sharks, which derives its name from the characters of the teeth. These are arranged in pavement-like manner, the better to crush shells and crabs, which form the major portion of its food. This shark forms the basis of an important fishery off the coast of South-West Victoria and frequently sells in the Melbourne Fish Markets at a greater price than that paid for Snapper. It is there usually called "flake," though it sometimes is given the name "Sweet William." This shark possesses an extremely delightful white flesh of excellent eating quality. Adelaide, at present, does not appreciate this fish; the hostess of a leading Adelaide hotel, after she had tried a piece of Gummy Shark, is

reported to have stated with a shudder: "It was all right, but I thought I was eating a man!"

HAMMER-HEADED SHARK *(Sphyrna zygaena).*

Fig. 14.

The easiest identified of all sharks. The sides of the head are produced and on the outer edges of these projections the eyes are situated. Specimens of 15 ft. and more are known, but of those so far captured in South Australian waters, especially in the neighborhood of Kangaroo Island, the largest weighed only 310 lb. They are considered almost as dangerous as the Tiger Shark. They are fairly common, eight having been seen cruising in deep water just off Glenelg Jetty in one afternoon in January, 1939.



Grey Nurse Shark caught at Robe.

THRESHER or FOX SHARK *(Alopias vulpinus).*

Fig. 15.

Another easily identified shark, for its tail is almost as long as the rest of its body. It grows to a length of 15 ft. and over, and is credited with being one of the most powerful swimmers in the shark family.

GREY NURSE SHARK *(Carcharias arenarius).*

Fig. 16.

A viciously toothed shark which is feared by bathers in eastern Australia in particular. The teeth are long and awl-like. Grows to a length of at least 15 ft. and is a fair sporting fish. The largest caught to date by members of the Game Fishing Club weighed 452 lb.

BLUE NURSE SHARK (*Carcharias tricuspidatus*)

Figs. 17 and 18.

Of larger size than the Grey Nurse. It is far from common in South Australian waters. The teeth are much larger and more formidable than those of the Grey Nurse.

LITTLE NURSE SHARK (*Triakis scyllium*)

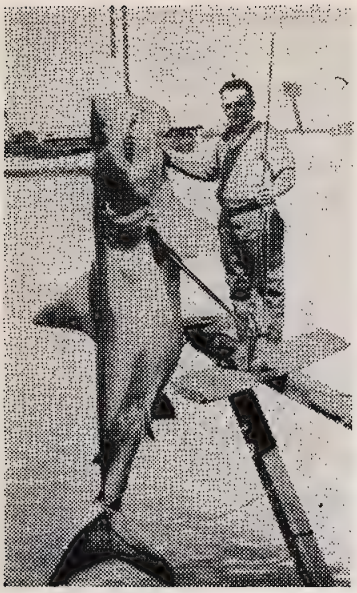
Fig. 19.

One of the small species of sharks, growing to a length of approximately 2 ft. 6 in. Its teeth are three-pointed, hence the name "Triakis." Only once has this species been recorded in South Australia.

ELPHIN SHARK (*Mitsukurina owstoni*).

Fig. 20.

Very easily identified species, one of which was captured at Goolwa. Grows to a length of 7 ft. First described by a Japanese.



This Grey Nurse Shark, 14 ft. long, and weighing between 800 and 900 pounds, was caught after a thrilling two-hour struggle at Robe, by Mr. Frank Went, a fisherman.

BLUE POINTER or SNAPPER SHARK (*Isurus glaucus*)

Fig. 21.

Very solidly built shark; not considered particularly dangerous to man. Its almost evenly lobed tail, together with its podgy body, will serve to distinguish it from most other sharks. Reaches a length up to 15 ft. This shark, which is a very fast swimmer, is considered by many to be The Mako of New Zealand. It is as readily sold in the Melbourne fish market as is the Sweet William or Gummy Shark.

WHITE POINTER or THE GREAT WHITE SHARK (*Carcharodon carcharias*)

Figs. 22 and 24.

One of the largest sharks in South Australian waters. Though it attains a length of 40 ft., no fish of that size has yet been captured by game fishermen. Many ranging upwards from 435 lb. have been caught, the largest last season being 1,023 lb. in weight. This season has seen that figure left behind, for Mr. G. R. Cowell caught a 1,291 lb. fish at Port Lincoln. This is a world's record catch. It abounds in waters in the Port Lincoln neighbourhood, and is even now one of the most sought after sharks by game fishermen. Its teeth are triangular and dangerous looking. Feared by bathers and also by boating men. There are several records on hand of attacks by this shark on "well" boats laden with fish.

BASKING SHARK (*Cetorhinus maximus*)

Figs. 23 and 25.

Another large shark reaching a length of 40 ft., but not considered dangerous to man. Readily distinguished from all other sharks by the immense size of its gill slits which extend from the top of the head right down to the throat. The teeth are small and claw like. Derives its name from the habit of lying motionless for long periods at the surface of the water.

ELEPHANT SHARK (*Callorhynchus milii*)

Fig. 26.

A peculiar shark of very primitive form. Gill slits are absent, the gills being concealed under an operculum. It has large fins and its peculiar proboscis makes it readily identifiable. The skin is smooth and possesses a beautiful silvery iridescent color. In recent months several species have been taken, the majority being quite small. It is here recorded that a party of fishermen, not knowing what it was, actually enjoyed a hearty meal from one captured in the neighborhood of Cape Jervis. Mr. Waite reports that, during one of the trawling expeditions attended by him, Elephant Sharks were served, but, though the flesh was eaten by the officers, it was thrown overboard by members of the crew, who, without tasting it, objected to being fed on shark.

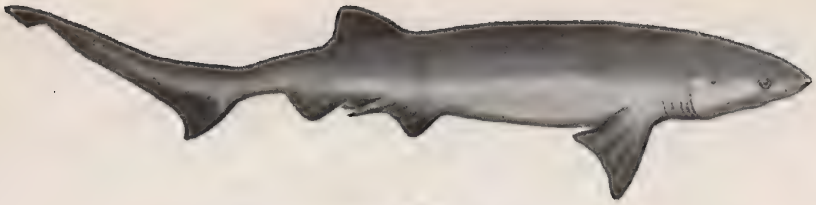
A word on breeding in sharks. Most of the larger species are viviparous, that is, the eggs hatch within the body of the mother and the young are brought forth alive. Many of the small sharks and the rays are

EXPLANATION.—A School Shark has been known to give birth to as many as fifty young. This is a batch of 12-inch long babies.

oviparous, producing eggs—usually of large size—which are deposited amongst seaweed or rock crevices, a horny case frequently embellished and usually provided with long entangling tendrils acting as protective covering to the egg. G. P. Whitley in the September 30, 1938. issue of "The Australian Museum Magazine" has pictured and classified a number of these egg cases which, he tells us, are also known as Mermaid's Purses and Sea Cushions or Barrows.

It would not be fitting to close this brief article without mention of the idea, held by so many, that a shark must turn on his back to enable him to take the bait or the food of which he is desirous of partaking. Admittedly, a shark's lower jaw is very much undershot. That is the expected place for it, since so much of its feeding is done along the bed of the sea. If, in imagination, we bring the food to anywhere below the surface, we again can readily see that it is in a suitable position for the shark to snap it up without the necessity to carry out any peculiar gymnastics. Now float the food on the surface and it will be realised that the shark has but to raise its head an inch or two out of the water to allow of the picking up of the food.

(Illustrations overleaf).



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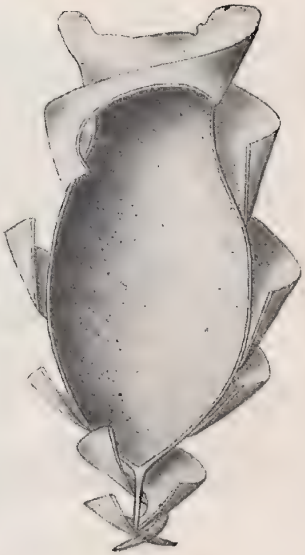

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Fig. 1—Seven-Gilled Shark.

Fig. 2—Teeth of the Seven-Gilled Shark.

Fig. 3—Egg Case of Port Jackson Shark.

Fig. 4—Case cut to show egg cavity.

Fig. 5—Port Jackson Shark.

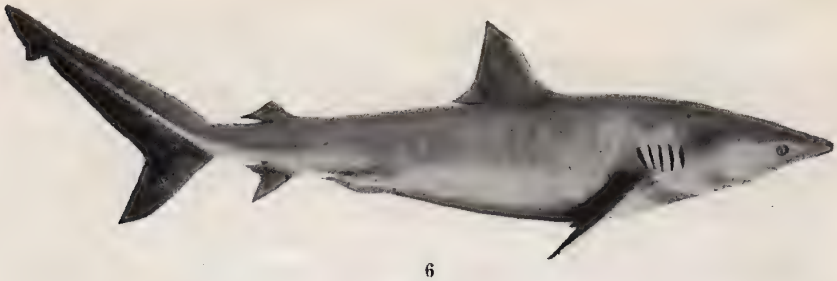

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Fig. 6—Cocktail Shark.

Fig. 7—Blue Shark.

Fig. 8—Teeth of a Tiger Shark.

Fig. 9—Tiger Shark.

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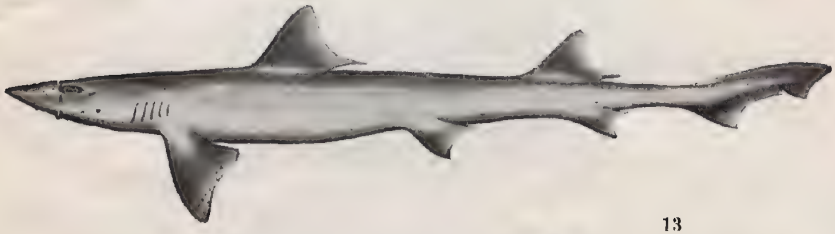

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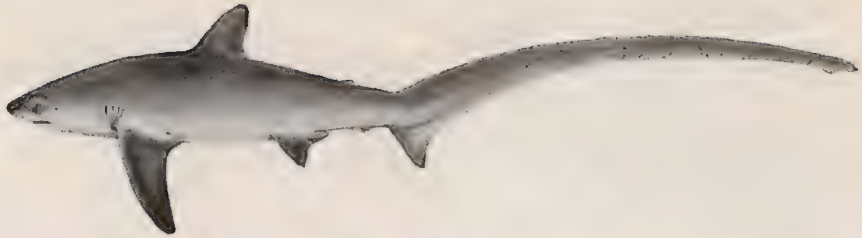
Fig. 10—School Shark.

Fig. 11—Teeth of a School Shark.

Fig. 12—Teeth of a Gummy Shark.

Fig. 13—Gummy Shark.

Fig. 14—Hammer-headed Shark.



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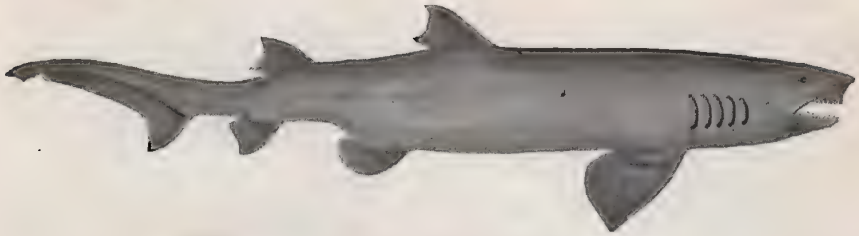

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Fig. 15—Thresher Shark.

Fig. 16—Grey Nurse Shark.

Fig. 17—Teeth of Blue Nurse.

Fig. 18—The Blue Nurse.

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Fig. 19—The Little Nurse.

Fig. 20—Elphin Shark.

Fig. 21—Blue Pointer.

Fig. 22—Teeth of a White Pointer.

Fig 23—Teeth of the Basking Shark.

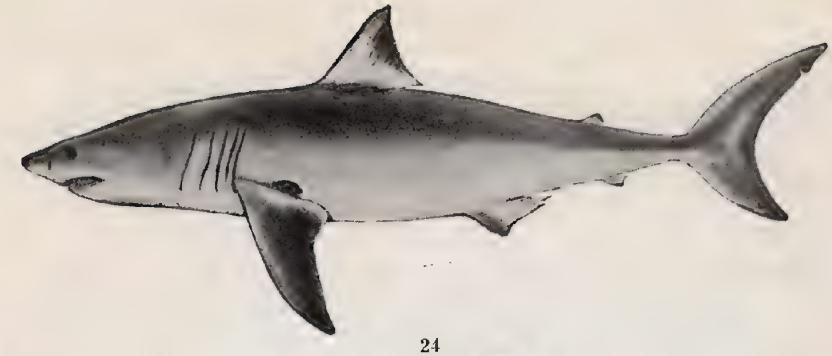

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Fig. 24—The White Pointer.

Fig. 25—Basking Shark.

Fig. 26—Elephant Shark.

The Age of the Stringybark

By W. Burdett.

I have not read at any time of anyone estimating the age of our stringybark forests, or the possible maximum life of an individual tree. Twenty years ago there were several hundred acres of virgin forest in the Basket Range district; now only small patches remain. Twenty years more and perhaps there will be no virgin forest left. We could have a few of these trees cut down, or a peg cut from them, and the yearly growth rings counted to tell the age. Who cares, you say! But there are other reasons besides curiosity. One of them is to find weather records. In Adelaide we have weather records for about 100 years. In these trees we have weather records for many hundreds of years, all carefully backed up for us to read. This only applies to the primary forests that have not been touched by man. Surely we ought to leave a record for the next generation, as, apparently, we are not going to leave any trees for them.

The Age of the Forest.

Suppose we guess 3,000 years as the age of the forest. You say, yes, maybe, 3,000 years is only a short time in the earth's history.

Then we guess 1,000 years as the maximum life of a single tree. Most people would guess less than this; we always have bushfires and white ants. If both our guesses were right two generations of trees would have died out, meaning that for every one growing two would have been dead and gone. The facts are that when the old sawyers first came into these hills they found an average of at least ten growing trees to one that had gone.

Either 1,000 years was too low a guess for the life of a tree, or 3,000 years was much too high for the existence of the forest.

Proof of Age.

Many acres of my fruit garden are composed of top soil of two inches to several feet in depth in the hollows; then a layer of quartz gravel; then a very tightly packed red clay subsoil. Tree roots growing in this clay naturally only grew or swelled out during the winter or early spring when the clay was wet and pliable. The clay around the roots was pressed unbelieveably hard, and left casts of the roots for all time.

The smaller root holes are now partly filled with decayed wood, the large one near the stump with ashes and top soil, never with the surrounding clay.

I helped to trench acres of this land with a pick, which was very slow work. I saw every inch of the earth down to a depth of two feet. That is how I know that there had been very few dead trees before the first sawyers came here.

This clay land is very interesting apart from preserving evidence of every tree that ever grew in it.

This clay and gravel can have very little or no vegetable content, and crumbles up when exposed to the weather. You can see this in the road banks—for the bank keeps crumbling back until the slope is gentle enough a covering of loose earth.

When these hills were first raised the clay would be weathered every summer, and the early winter rains would wash away enormous quantities. This would happen every year. Through the clay there are small broken up quartz veins. When the slope was not too steep these small pieces of quartz began to hang back, and eventually cover the clay and stop the weathering.

It must have been on this layer of gravel that the first vegetation started, because from here upward the soil is composed principally of vegetation. At the present time, where the top soil has been removed, our native trees and bushes will thrive in the gravel.

In the gravel, but resting on the clay, we sometimes found large pebbles, 4 to 8 inches in diameter, of a very hard rock and very much water worn. The pebbles must have been formed in an old water course that existed before these hills were raised to their present level.

White Crows, Pink Magpies and Heredity

By H. T. CONDON.

Freaks have fascinated mankind from the earliest times. To-day, deviations from normal color, shape or size, however slight, are prized by the aviculturalist. By the systematic worker they are either completely ignored, or they may be regarded as sub-species, and have varietal names bestowed upon them. To anyone who has studied or observed any one species, such as the Crow (*Corvus cecilae*), or the Magpie (*Gymnorhina hypoleuca*), it is quite obvious that a great number of variations do occur in the wild state, and in fact it is an assemblage of such individual variations which forms the species. In this account, however, we are not concerned with the numerous subtle variations which are known, but with the rare and spectacular examples which arise from time to time.

The beautiful colors of birds' feathers may be pigmentary or structural. The presence of pigments in the feathers, such as those of the melanin class, may produce reds, browns, or blacks, while various pigments known as carotenoids, produce yellows, oranges, and reds.

Individuals whose tissues lack the power to form melanin are termed albinos, and *may* have snow-white plumage and colorless feet, bills and eyes, which appear to have a pinkish tinge owing to the presence of blood. Many albino birds are beautiful creatures. Authentic records are known of albinos of the following species in South Australia, which are now preserved in the South Australian Museum, viz., Mutton Bird (*Puffinus tenuirostris*), Galah (*Kakatoe roseicapilla*), Adelaide Rosella (*Platycercus adelaidae*). Mallee Ringneck Parrot (*Barnardius barnardi*), Stone Curlew (*Burhinus magnirostris*). Golden-headed Fantailed Warbler (*Cisticola exilis*), New Holland Honeyeater (*Meliornis novae-hollandiae*), Red-browed Finch (*Aegintha temporalis*), Crow (*Corvus sp.*), White-backed Magpie (*Gymnorhina hypoleuca*).

It is a strange fact that the suppression of melanin has no effect on the yellow or red pigments, and an albino Galah will exhibit the roseate face and breast of the normal bird.

In Australian birds the various shades of blue are reflected colors, depending on the minute structure of the feathers for their appearance. Green feathers are actually yellow-pigmented feathers, with a green producing superstructure, which in the absence of yellow would reflect blue light.

Changes in the melanin material often give rise to strangely-colored individuals very similar to genuine albinos in some cases. In other cases the black coloration is merely changed to some other shade, and thus we have "pink" Magpies, when there is a great reduction or alteration, and "blue" individuals when this change is only of a minor nature. Excessive formation of melanin in the feathers results in a condition known as melanism, when the plumage assumes a dark or sooty color. An example of a jet-black Magpie is contained in the Museum collection. Until recently, surprisingly little attention has been paid to the problems which these creatures present.

That certain laws govern the appearance of albinos has been proved by careful experimental breeding under ideal conditions. Little is known of the reasons for the appearance of "pink Magpies" and the like, which can only be discovered also by experimental breeding.

We must be careful, however, to discriminate between variations which are inheritable, and those which are merely the outward expression of some upset in the physiological processes of the individual. Examples of this are the excessively long beaks and claws of old birds, and odd white feathers scattered in otherwise normal plumage.

It is a property of living things to produce their kind, and while in the beginning the young may differ noticeably from their parents, they nevertheless in process of growth, come to resemble them. This tendency to reproduce the characters of the parent is called heredity.

In birds such well-defined features as plumage patterns, color, size of beak, number of toes, length of tail, and so on, may be regarded as hereditary characters. Such features are often referred to as "unit characters," and are represented in the germ plasm

of the animal by certain clear-cut and apparently independent and relatively stable items known as "factors" or "genes." It must be remembered that strictly speaking it is the factors capable of producing the unit characters which are inherited, and not the characters themselves. Occasionally one or more of these factors may change or disappear from the make-up in an individual bird. The cause of this is not known, but the result is an imperfect individual such as an albino, very different in some ways from its parents. Such creatures are known as "sports" or "mutants," and when bred together reproduce their kind. In other words, the changed characters which they possess are hereditary characters.

In nature the fate of sports is usually sealed, and they and their kind disappear from one of three causes. Firstly, they may be regarded as "outcasts" by normal individuals of their own species, and so deprived of an opportunity to breed and reproduce their kind; secondly, they may perish early in life through being unable to compete with their better-equipped normal relatives; or, thirdly, they may interbreed with normal birds, the resulting offspring being normal in appearance, while possessing the factors or genes of the abnormal parent as hidden characters in their make-up.

Such individuals are termed heterozygous, that is they possess "unlike characters." A familiar example of a heterozygous individual is the green Budgerigar, produced by aviculturalists by the crossing of a yellow bird with a blue bird, both of which are homozygous. Although green in color, and apparently similar to the wild green bird, this individual possesses certain factors which would cause the appearance of some yellow and some blue as well as green birds among its offspring.

It is believed that the *reappearance* of a "sport" in nature is due to a shuffling of the factors in their transmission from one generation to another, so that when two heterozygous individuals meet, the resulting offspring exhibit the characters of the original mutation.

Notes on the Birth of a Black-Faced Kangaroo

By

JACK CARR and R. BLANCHARD.

For six years Mr. George Carr has kept in captivity a pair of Black-faced Kangaroos which originally came from Marion Bay, Yorke's Peninsula. During that time the female has produced two single Joeys, which in both cases first showed their heads above the pouch about September, and first hopped out of the pouch in October. In November, 1937, the mother Kangaroo was suffering from what appeared to be pneumonia, and was so sick that the young-one she then had was taken away from her.

On December 8, 1938, between 6.30 and 6.45 p.m., as we were passing the enclosure containing the Kangaroos, the female was standing upright, slightly bent over, and licking herself. We then noticed that a tiny Joey was just being born. It was all pink flesh and about the size of the top of a finger. It at once commenced to crawl up the fur towards the pouch. It did not seem to be using its hands, but was working along in the same manner as a looper-caterpillar, stretching out, then dragging itself forward, and so on. The Joey was right outside the fur, and the female kept licking herself as the Joey was crawling, but never once did she touch the baby.

From the time of the birth to when the baby Kangaroo was safely inside the pouch could not have been more than five or six minutes.

The pouch closed after the young one went inside.

Observations on a Native Land Snail

EXILIBADISTES SUTILOSA (*Deshayers*, 1850).

By Bernard C. Cotton and Wesley M. Nielsen.

On September 18, 1938, we visited the most northern of those interesting hills known as the Three Sisters, or Black Hills, at Highbury East, near Adelaide, in search of land snails.

A find of particular interest was made on this occasion, when after several hours intensive search and turning of many stones, a native land snail, *Exilibadistes sutilosa*, was found brooding over a clutch of fifty eggs. The eggs were clustered in a burrow approximately one inch in diameter, and some six inches in depth, and sloping at approximately 45 degrees. It is not known whether the burrow was made by the snail or by a species of frog, considerable numbers of which were observed in the vicinity.

The burrow contained a quantity of decaying leaves, and both these and the eggs were quite moist with saliva, giving the impression that they had been recently deposited. The eggs were ovoid, elastic, sticky, white, and measured 5 mm. by 4 mm.

Below and under the decaying leaves, 12 further eggs, smaller and darker in color, were found. The whole of the eggs were placed in a glass jar and kept under observation.

On October 8th to 12th the eggs hatched, and fifty snails and twelve slugs appeared. The diameter of the shells on hatching was 2.5 mm., and this increased to 5 mm. by January 21, 1939. The rate of growth measured by the diameter was .024 mm. per day, or approximately .075 mm. of shell was added to the outer lip per day.

The species was originally described in 1850 from St. Peter and St. Francis Islands. Later Brazier described a similar species, from near Adelaide as *Helix bednalli*. This is the Mt. Lofty Range sub-species, which differs from the island forms in being larger, smoother, and having the columella reflected over and covering the umbilicus. A series of living specimens, taken by Mr. H. M. Cooper at Hog Bay, Kangaroo Island, during March, 1939, confirms these differences. We retain the name *Exilibadistes sutilosa bednalli* subspecifically for the Mt. Lofty Range specimens.

The identity of the slugs is as yet undecided. Several hours were spent on the southern side of the hills, by a creek near which might be considered an ideal environment for native snails, but only a few of the small *Echonitor cyrtochilus* were obtained together with a dead shell of species *Strangesta gawleri*, which is obtained alive at various localities in the Mt. Lofty Ranges. On passing over the brow of the hill to the somewhat drier northern side, a number of *Exilibadistes sutilosa* were found under stones and old wheat bags.

The top soil was mainly compact loam, and the height above sea level ranged from 100 to 500 feet.

The stones under which the snails (*Exilibadistes*) were found are of quartzite. Vegetation was scarce, and only several large gum trees were in the vicinity.

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The South Australian NATURALIST

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"South Australian Naturalist":

Editor: Mr. B. C. COTTON, The Museum, Adelaide.

EXCURSIONS.

1939.

June 12—Monarto South. Motor, 9 a.m. 4/6. Birds. Mr. W. D. Wade.

June 17—Town Hall, Civic Museum. 2 p.m. Mr. Morison.

June 24—Outer Harbor South. Train, 1.10 p.m. Echinoderms. Mr. F. K. Godfrey.

July 1—Museum. 2 p.m. New Additions. Mr. H. Hale.

July 8—Largs North. Train, 1.10 p.m. Foraminifera. Mr. R. C. Shinkfield.

July 22—Waterfull Gully Reserve. Motor, 1.45 p.m. Fungi. Professor J. B. Cleland.

August 5—Belair. Train, 1.14 p.m. Orchids. Mr. H. Goldsack.

August 19—Brighton. Train, 1.11 p.m. Marine Invertebrates. Mr. B. C. Cotton.

August 26—National Park. Train, 1.14 p.m. Parasites. Mr. E. H. Ising.

EVENING MEETINGS.

June 20—"Across the Continent and Back in Two Days," Mr. S. R. Harry.

Central Australian Evening. Exhibits wanted.

July 18—"The Koonamore Vegetation Reserve," Professor J. G. Wood.

August 15—Annual Meeting.

Members are requested to bring exhibits whenever possible.

MOTOR EXCURSIONS.—Meet at the Town Hall, Adelaide. Bookings close with the Secretary or Treasurer three days before excursion, and seats will be allotted in order of priority.

Some Fishes Hitherto Unknown From South Australian Waters

By

HERBERT M. HALE,

Director, South Australian Museum.

FAMILY SCYLIORHINIDAE.

CEPHALOSCYLLIUM ISABELLA.

(*Bonnaterre*).

Color Plate, Top Figure.

The little Swell Shark resembles a Carpet Shark rather than the Cat-fishes of its family. Specimens have been taken previously in Victoria, Tasmania, and New Zealand, but the species was not known from South Australian coasts until June 22, 1931, when Mr. E. A. Sheridan found a full-grown female in one of his crayfish pots, one and a half miles W.S.W. of Cape Catastrophe, in sixteen fathoms of water. Mr. Sheridan placed the fish in the well of his fishing cutter, and there it laid the egg shown in the figure.

Egg of Swell Shark (*Cephaloscyllium isabella*).

Mr. G. P. Whitley (Ichthyologist at the Australian Museum) once held the opinion that this shark deposited a ribbed, or laminated, egg (Rec. Aust. Mus., XVIII, 1932, p. 323). In a recent paper dealing with the eggs of Australian sharks and rays (Australian Museum Magazine, VI, 1938), however, he recalls the fact that a "laminated egg" was figured, unidentified, by Dumeril in 1865, and goes on to refer it provisionally to a species of *Parascyllium*. At the same time, he identifies a smooth-surfaced egg as belonging to the Swell Shark. This conjecture was proved incorrect by the captive South Australian Swell Shark, which deposited a "laminated egg." These transversely ridged eggs are occasionally washed up on the shores of St. Vincent Gulf, so that the species is probably not as rare as one might suppose.

The female Swell Shark captured by Mr. Sheridan was 2 ft. 10¼ in. (870 mm.) in length. Photographs and color sketches of the living animal were made at the Museum. The coloration of the dorsal surface was chestnut-brown with the top of the head somewhat paler, and with a narrow paler band extending from the posterior edge of the eyes to just behind the spiracles; similar bands were present posterior to the pectoral fins, in the neighborhood of the ventrals, between the dorsal fins, and between the second dorsal and the caudal fin. The underside was cream-colored, with brown mottlings, accentuated about and behind the mouth, in front of the vent, and on the tail and distal portions of the ventral fins. The general coloration may be described as dark: both fins and body are marked with dark spots and there are sparse irregular spottings of white. The base of the anal fin is subequal in length to its distance from

the origin of the lower caudal lobes. The distance from the snout to the first gill-slit is less than one-sixth of the total length and equals the distance between the origin of the dorsal fins; that is to say, the distance from the snout to the origin of the pectorals is equal to that from the origin of the first dorsal and the end of the second dorsal fin.

A smaller female was captured by Mr. McDowall in deep water south of Kangaroo Island on March 8, 1929. This specimen laid two laminated eggs, similar to the one illustrated, in the well of Mr. McDowall's boat.

In colouration, this example was not so reddish as that captured by Mr. Sheridan, and possessed more small black spots, while the banding was quite indefinite. The base of the anal fin is almost equal to the distance between the posterior insertion of the pectoral and its own origin, and is distinctly longer than its distance from the origin of the lower caudal lobes. The distance from the snout to the first gill-slit is almost one-sixth of the total length, and is equal to the distance between the origins of the fins.

In regard to the breeding season of the species in South Australia, it may be noted that the freshly laid egg of a Swell Shark was cast up at Cape Thevenard on October 12, 1934, and another with a young shark inside was found at Coffins Bay in September, 1936.

FAMILY SYNGNATHIDAE.

HISTIOGAMPHELUS MACULATUS *sp. nov.*

Color Plate Bottom Figure and Text Figure. Female. Dorsal fin with 24 rays; pectoral with 12 rays; caudal with 8 rays. Thoracic annuli 20; tail rings 33. Subdorsal annuli 5 + 2.

Head about five times into length of trunk and ten times into total length; snout 2.75 into the head; eye 2.3 into the snout and nearly 7 into the head. Trunk subequal in length to tail. Caudal fin 2.5 in head.

Snout 1.75 in rest of head; dorsal crest bisinuate, with a marked incision in advance of eye; supraorbital ridges not continued into dorsal outline of head.

Body with eight ridges; crest of the snout continued as a low ridge on to the second (or pectoral) annulus, where it fades out, but recontinues on the fourth annulus and extends thence to the anterior end of the dorsal fin; the latero-superior ridges end underneath the twentieth dorsal fin ray; the medio-lateral ridges end on the last thoracic annulus beneath the anterior ends of the upper caudal ridges; a prominent abdominal ridge. Tail square in section with four ridges. Anal fin minute and caudal spear-shaped.

Head of *Histiogamphelus maculatus.*

Color: Reddish-brown, tinged with orange on postero-lateral parts of thorax; thoracic annuli with bold atroceruleus spots disposed as shown in the color illustration and with a sparse sprinkling of minute pearly dots on the upper part. On the anterior half the underside of the tail is pale brownish-orange, with darker mottlings and with a prominent white spot on the sixth and ninth rings: these spots extend on to the lateral faces of the annuli; on the hinder half the venter is dark brown.

Length: 265 mm.

Loc.: South Australia, Gulf St. Vincent, Aldinga Bay (J. D. McDonald, Dec., 1938). Type, female, in South Australian Museum, Reg. No. F.2039.

H. maculatus may be separated at a glance from the only other species of the genus hitherto recorded from South Australia—*H. rostratus* Waite and Hale—for the last-named has the snout twice as long as the rest of the head.

The new species resembles *H. briggsii*

FISHES NEW TO SOUTH AUSTRALIA.

Top: *Cephaloscyllium isabella* (Bonnaterre).

Middle: *Cridorsa moonta* Whitley.

Bottom: *Histiogamphelus maculatus* sp. nov.

McCulloch in some respects, but differs in having the snout relatively much shorter, with the crest bisinuate and the low ridge defining the upper edge of the snout not subparallel to the dorsal margin of the crest; in having the supraorbital ridges separated from the profile, in the lesser number of annuli, etc. The coloration also is distinctive and entirely different.

FAMILY NOMEIDAE.

CRIDORSA MOONTA (*Whitley*).

Color Plate, Middle Figure.

On March 4, 1938, a small unknown fish was caught by Mr. H. Kemp at Moonta Bay and was sent by him to the Museum for identification. As it was quite unlike any member of the family previously recorded from Australia, a colored drawing was at once made of the fresh specimen, and this is reproduced herewith. The fish was then sent to Mr. G. P. Whitley, of the Australian Museum, for description, and in the current number of the "Records of the South Australian Museum" that author proposes the new genus *Cridorsa* for its reception. (Rec. S.A. Mus., VI, 1938, p. 159, pl. XVI). The striking coloration of the species is shown in the plate herewith. The length of the fish is 2.2 inches or 45 mm.

FAMILY ZEIDAE.

ZENOPSIS NEBULOSUS (*Temminck and Schlegel*).

This striking fish is known as the Mirror Dory because of its silvery body and subcircular shape. It is a deep-water species and has been found in the seas of Japan, New Zealand, Victoria, Tasmania, and New South Wales; it is taken by deep-sea trawlers of our eastern States, but was unknown in South Australia until June, 1933, when the example illustrated (1 ft. 6¾ in. or 475 mm.) was hooked by a fisherman near Kangaroo Island. The photograph is of the cast exhibited in the Museum.

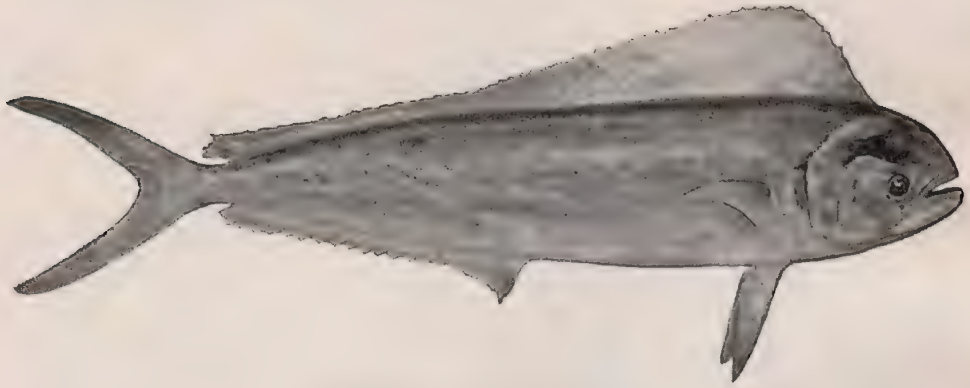
FAMILY CORYPHAENIDAE.

CORYPHAENA HIPPURUS (*Linnaeus*).

The Dolphin or Dorada inhabits the open ocean and is found in all warm seas. Modern sailors have misapplied the name "Dolphin" to this fish, and it must not be confused, of

Mirror Dory (*Zenopsis nebulosus*).

course, with the true Dolphins or porpoises, which are mammals. Although in Australia it has been recorded from New South Wales, there has been no record of its occurrence in the inshore waters of Southern Australia. The first example to be noted in our State was taken at Port Wakefield, right at the shallow northern end of St. Vincent Gulf; it was 3 ft. 4 in. in length and was caught



"Dolphin" *(Coryphaena hippurus)*.

by Mr. G. W. Forrest on February 1, 1931. The coloration was described as "bright azure blue" when freshly caught. Only portions of this specimen were preserved.

Coryphaena appeared again in St. Vincent Gulf on January 7, 1938, when a fisherman (Mr. Swayne) hooked one of a number of individuals; this example was 2 ft. 4¼ in. (720 mm.) in length, and a plaster cast was made from it for exhibition in the Museum.

FAMILY TRICHIURIDAE.

LEPIDOPUS CAUDATUS (*Euphrasen*).

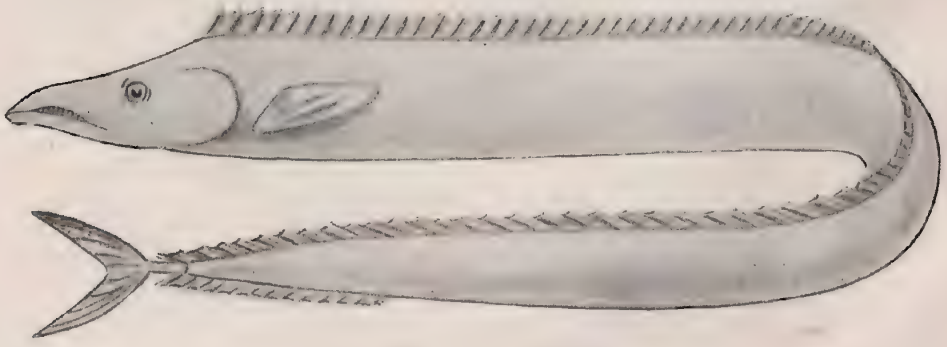
The striking Scabbard-fish has a wide distribution in both hemispheres, but has rarely been taken in Australian seas. The species attains a length of six feet, and it is sometimes thrown up on beaches in New Zealand in considerable numbers. It is said that specimens are usually stranded during cold frosty weather and that this fact is responsible for the popular name, "Frost fish," in New Zealand.

A fine example, 5 ft. 4½ in. (1,640 mm.) in length, was collected at Glenelg in St. Vincent Gulf by Mr. C. Jordan on August 15, 1931. A cast of this specimen is exhibited in the Museum.

FAMILY SCORPAENIDAE.

NEOSEBASTES PANDA (*Richardson*).

Richardson, the author of the species, gave this fish the popular name of "Saddle-skull Scorpaena." It occurs in Western Australia, Victoria, and Tasmania, but has not been definitely recorded previously from South Australia. Waite included the species in his



Scabbard-fish *(Lepidopus caudatus)*.

"Catalogue of Fishes of South Australia" (1921, p. 64) because it had been taken in the Great Australian Bight (see his Catalogue, p. 1, par. 2) west of Eucla ("Endeavour" Sci. Res., III, 1915, p. 154) and in Victoria; he then stated that *N. panda* is "not so well known here as in Victoria, where it is a common market fish." In his later handbook, "The Fishes of South Australia" (1923, p. 189) Waite remarks: "This is a Western Australian fish and has been taken in the Bight; it is not known how far it extends eastwards." In his "Checklist of Australian Fishes," McCulloch omits South Australia as a locality for the species (Mem. Aust. Mus., V, 1930, p. 386) doubtless because he was aware that its inclusion in Waite's catalogue was based on the west of Eucla record.

It is desirable to clear up this point because *N. panda* is not uncommon in our State and individuals are preserved in the South Australian Museum from a number of localities in both Spencer and St. Vincent Gulfs.

Rare Whales in South Australia

By
HERBERT M. HALE,
Director, South Australian Museum.

FAMILY ZIPHIIDAE.

During the last six years eleven Beaked Whales have been stranded on South Australian beaches. It is highly improbable that this represents the total number which have come to grief on our southern shores during that period. When one considers the three to four hundred miles of almost deserted and rock-bound coastline of the eastern half of the Great Australian Bight, comprising the western portion of the sealine of South Australia, the Ninety-mile Beach opposite the Coorong in the southeast, and other lonely stretches, it seems certain that many whales may have been cast up and never seen. Again, small stranded whales may have been observed by local residents in isolated districts but not reported. Almost without exception, the smaller whales have been identified by fishermen as the common Black-fish (*Globiocephala melaena*), and regarded as of limited interest.

The Beaked Whales previously recorded, and those mentioned below, were all cast up during the summer, seven of a total of fourteen individuals being stranded in the month of February and five in January.

Hyperoodon planifrons	1	Pt. Victoria	Nov. 1928
Berardius arnuxii	1	Pt. Lorne	Jan. 1936
Mesoplodon grayi	1	Younghusband Penin.	(1)Feb. 1931
Mesoplodon layardii	1	Kingston	Feb. 1919
,,	1	Pt. Victoria	Dec. 1929
,,	2	Victor Harbour	Feb. 1931
,,	1	Coffins Bay	Feb. 1933
,,	1	Streaky Bay	Jan. 1934
,,	3	Victor Harbour	Jan. 1939
,,	2	Streaky Bay	Feb. 1939

(1) According to local fishermen, this little whale had been cast up three months before it was secured by us in May, 1931.

PORPOISE WHALE.

BERARDIUS ARNUXII (*Duvernoy*).

About a dozen specimens of this toothed whale have been recorded from New Zealand and the Argentine. It is now possible to add the species to the known Australian fauna.

Early in January, 1936, Mr. J. J. Waters reported that he had observed a whale about half a mile from low water mark on a big sand bank about two miles south of Port Lorne, near the northern (or top) end of St. Vincent Gulf.

Mr. Waters stated that, on December 27, 1935, his boat approached to within a few yards of the whale, and he was able to make the following observations. The whale was alive, and from time to time expelled air with a low "whish"; it was moving its head from side to side. was wounded, and was bleeding, apparently from the mouth. The color of the back was black.

Mr. George E. Mardon stated that, early in January, 1936, a big sword-fish and a whale were floating in the Gulf near Port Lorne, both being then dead. The occurrence of a large wound in the side of the whale, and

the presence of the sword-fish, may have some significance in view of the fact that occurrences of attacks on whales by sword-fish have been reported.

On January 6, 1936, in company with our preparators, the writer examined the stranded whale, which proved to be twenty-nine feet in length. It was then about one mile north of Port Lorne and was considerably decomposed; the skin was much fissured and sloughing, and oil was escaping freely.

Although the animal was in this bad condition, a pair of throat grooves, as shown in the photographs, were very apparent. Both pairs of teeth had been removed by visitors, but these were soon recovered, and there was then no doubt that the species was *Berardius arnuxii*. The skull and most of the skeleton were secured for the Museum.

STRAP-TOOTHED WHALE. MESOPLODON LAYARDII (*Gray*).

The first example of the Strap-toothed Whale to be recorded from South Australia was desscribed by Waite in 1922 (Rec. S. Aust. Mus., 2, p. 209, pl. 2-3). Since then, ten specimens have been stranded in the vicinity of townships and so have been noticed; it is evident that the species is not uncommon off our coasts.

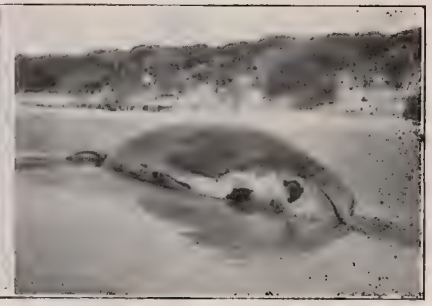
In 1931 (Rec. S. Aust. Mus., 4, p. 306, fig. 20-27), the writer recorded three specimens—one from Port Victoria and two from between Victor Harbour and Port Elliot in Encounter Bay. Following this, a male example was stranded inside of Coffins Bay, Eyre Peninsula, five miles from Point St. Isaac, and close to Whalers Well, in February 1933. The teeth were collected by Mr. William Morgan, who also took a number of photographs of the specimen. These were examined by the writer some time later, and proved without doubt the determination of the species; the teeth were practically identical in size and shape with those illustrated in fig. 24, a and b, in the above-mentioned paper.

An unsexed example, 15 feet 6 inches in length, was cast up on the beach at Streaky Bay on January 14th, 1934; its skull was secured by Mr. R. L. Bebbington, and is now in the South Australian Museum.

On January 12th, 1939, three females were cast up on the beach between Victor Harbour and Port Elliot. These were respectively 14 feet 10 inches, 14 feet, and 13 feet 3 inches in length. The complete skeleton of one example and the skulls of the other two were secured for the South Australian Museum. The accompanying photograph was kindly secured by Mrs. K. Roach of the Adelaide University, and shows the general features of one of these specimens. The belly in each individual was creamy-white, as shown in the picture, and the back sooty.

On February 2nd, 1939, two small whales were stranded at Wharffs Point, off Pigface Island, and near Streaky Bay. At my request, Constable Brock, of Streaky Bay, was good enough to make a detailed examination, and his description and photographs indicate that they were representatives of

Throat grooves of Porpoise Whale *(Berardius arnuxii)* at Port Lorne, South Australia.



Strap-toothed Whale *(Mesoplodon layardii)*, near Victor Harbour, South Australia.

this species. They were respectively 19 feet and 12 feet in length.

The teeth had not erupted in any of the eleven specimens of *M. layardii* so far recorded from South Australia, and it was not until the gums were removed that they were seen.

NOTE ON THE VOICE OF THE SOUTHERN BOTTLENOSE.

HYPEROODON PLANIFRONS *(Flower)*

In recording this species from South Australia in 1931 (Rec. S. Aust. Mus., 4, p. 291), the writer had to report that "none of the numerous visitors heard any sound from the dying creature, that is, no evidence of a voice." A little later, Mr. E. H. Millar, of Minlaton, visited the Museum with photographs of the whale and then stated that he had observed it when first stranded and that it was alive for two days. Mr. Miller then volunteered the information that when it was first aground it "made a grunting noise like a pig, with an occasional squeal, in its efforts to get back into deep water."

FAMILY PHYSETERIDAE.

PIGMY, OR SHORT-HEADED, SPERM WHALE.

KOGIA BREVICEPS (*Blainville*).

The rare Pigmy Sperm-whale has been taken in all seas, but, until now, the only record of its occurrence in South Australian waters consisted of a lower jaw washed up at Encounter Bay half a century ago.

Between 4 and 5 p.m. on April 25, 1937, a little female whale was stranded alive at Port Victoria, in Spencer Gulf, South Australia. At the same time, a smaller example, which was accompanying the female prior to her stranding, was seen swimming about close to the shore, and later on the same date this individual was also cast up on the beach. Mr. H. E. A. Edwardes, of Port Victoria, telephoned a description which left little doubt that these were Pigmy sperm whales, and so the difficult task of transporting the specimens from the beach, over the cliffs, and to the roadway was undertaken. The whales arrived at the Museum on April 28, and proved to be examples of *Kogia breviceps*. After a preliminary examination, plaster moulds were made of both. In the

Foetus of Pigmy Sperm Whale *(Kogia breviceps)*.

flesh, the female was 2,897 mm. (9 ft. 7 in.) in length, and the calf, a young female, was 1,710 mm. (5 ft. 7½ in.) long. Notwithstanding its relatively large size, the calf was evidently still being weaned, for the mammary glands of the mother were active and there was milk in the teat-slits. The color of both examples was jet black above, fading into the white of the underside.

The uterus of the adult female contained a foetus 203.2 mm. (8 inches) in length, a photograph of which is reproduced herewith.

The stomach of the juvenile female contained remains of numerous small Cephalopods—beaks, funnels and corneas; Mr. B. C. Cotton identifies these as *Sepioteuthis australis*. The stomach contents of the adult female consisted only of scanty remains of the exoskeletons of prawns, apparently referable to *Peneus* and *Hymenodora*.

The skeletons of the mother and calf, and the foetus of the first-named, have been preserved in the South Australian Museum.

Comparison Between Northern Australian Spear and New Guinea Arrowhead

By R. Murray Berndt.

It is the Magdalenian Man of the second part of the Palaeolithic Age that we have to thank for the invention of bone harpoons. These were of reindeer horn in the round and, in the latter days of this Age, were often ornamented with conventional patterns, but in earlier times a single row of barbs, varying little in fundamental principle from the Australian spear and the New Guinea arrowhead, sufficed.

The Magdalenians had no bows, so that when they wished to throw a dart, harpoon, or arrow beyond the distance of their own capacity they used throwing sticks, examples of which exist even now among the Eskimos, Mexicans, and Peruvians, and the Australian Aborigines.

It takes few steps from the invention of the spear-thrower to that of the bow and arrow, with which the New Guinea native attained such astounding skill of usage.

Chosen for description in this paper are two spears from Northern Australia which bear comparison with those of the New Guinea area. The other illustrations show arrows, whose designs can be compared with the Australian Aborigine decorative art.

From an examination of a large number of arrows, the writer feels certain that the skill of the Melanesian people, as shown in the decoration of these weapons is unsurpassed by any other living primitive race, and when one considers the difficulties they have overcome in the working of available materials, the incising and carving of designs, one realises the centuries of culture and the background of inventions leading up to this stage.

The distribution of the arrow in New Guinea is widely spread, and is traded from the mainland to the Torres Straits islands, where variations of the South Coast arrow are met with (Haddon, 1894, p. 46).

Haddon (1912, p. 173) states that bows and arrows are the only missile weapon employed in the Torres Straits, with the exception of the javelin, the use of which is confined to certain of the western islands. It is doubtful whether any of the aborigines of North Queensland really employed the bow and arrow. Specimens have been seen at Cape York, but it must be remembered that certain Western Islanders were in the habit of visiting that district, and as soon as Europeans began to fish and trade in Torres Straits they made Somerset in Albany Pass their headquarters, and brought in their train, numerous islanders.

The bows seen by travellers (Ratzel, p. 354, shows an illustration of such a bow) may have been in the hands of visiting islanders only, and even if they belonged to Australians, may have been imported from the islands. But the bow and arrow can in no way be regarded as an Australian weapon.

Still through the course of the ages, one can easily suppose the diffusion into Australia, via Torres Straits and Northern Queensland of perhaps a little of the culture of the Melanesian, carried over by some individual. Such a person may have been driven to the Australian mainland by storm, adventuring, bringing with him a remnant of his social and artistic life, and in so doing, influence the aborigine to adopt or adapt the ways different to those of his own.

In the accompanying drawings, the conventionalised New Guinea decoration is seen to be closely allied to the Australian. Only a study of its underlying meaning can

reveal its full significance. For our interpretation of primitive art, we are dependent upon an analysis of the native artist's social and ceremonial code. It is traditional, as likewise are his designs, and have been laid down by his tribal forefathers, from which he must not deviate.

McCarthy (1938, p. 47) states that the most distinctive feature of the geometrical art of Australia is the regional occurrence of concentric figures, either formed on a single continuous line, or consisting of separate figures increasing in size from the centre outwards, combined with flutings in various patterns.

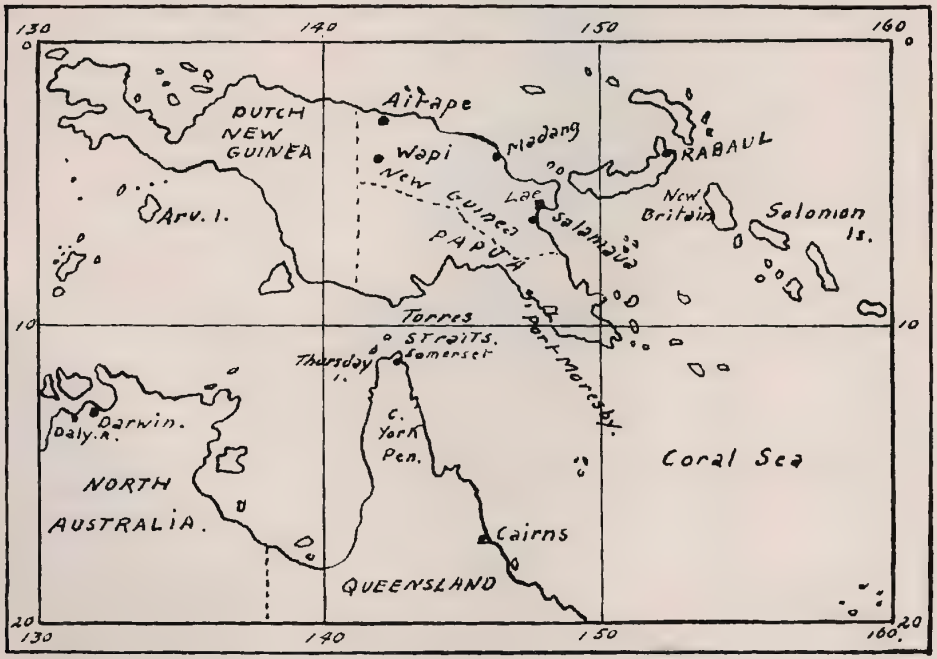
The concentric diamond and circle elements are the most widely distributed motifs, and would appear to be the oldest.

Mountford (1937 A, p. 226) has dealt with the concentric square, circle and diamond shaped decoration of South-Western Central Australia. These are relating to totemic places, and the aborigine artists interpretations and legends of the designs are set out fully.

Mountford (1937 B, p. 22) deals with the meanings of the concentric circle and spiral in the crayon drawings from Warburton Ranges in Western Australia, which relate to the wanderings of two ancestral beings, "the Wati Kutjara." But it is not always possible to obtain meanings of these important symbols, and in some cases the origin is obscure. It appears frequently in the decorative art of New Guinea, Melanesia, and Polynesia, and in fact, throughout the world.

The accompanying illustrations of arrows and spear heads are chosen for comparison. No. 1 is a Northern Australian spear from Daly River, near Port Darwin. Although the barbs are on one side, many examples exist in which there are barbs on both sides of the point. It resembles that of a Magdalenian harpoon head, and compares remarkably with No. 2—from the north coast of New Guinea. This arrow has elongated barbs, facing each other as in No. 1, with almost same finish to the point. The New Guinea arrow is painted with red, white, and black parallel lines, and the Australian spear, with white lines. The two weapons bear even a greater similarity when placed together, as both are manufactured from the same red colored hard wood.

Length of spear point, 55 cm.; overall, 303 cm.



Map giving localities of four weapons described in the text.

No. 3 is a spear head from the Larakeyah tribe, Port Darwin, having four barbs cut from the square in the manner of the arrows from the North Coast, New Guinea. While the head is undecorated, the base of the point has a design in white color, which is similar to that on Nos. 3 and 9.

Length of arrow point, 44 cm.; overall, 146.5 cm.

No. 4, from North Coast, New Guinea, is barbed in the same principle as No. 3, and decorated. The concentric circles have disappeared altogether, leaving only arrow shaped lines. The blackwood point bound to the shaft, is colored in red and white.

Length of point, 49 cm.; overall, 140 cm.

No. 5, a conical arrow from Port Moresby, consists of a series of cones of blackwood, of unequal length, leading one into another, and a design on the base. The whole is bound to the shaft with waxed palm-leaf.

Length of point, 44.5 cm.; overall, 152 cm. The conical points were nicked before use, in order that they might readily break off and remain within the body of the enemy. (Haddon, 1912, p. 177).

No. 6, from Atiape district, North Coast, resembles Nos. 3, 4 and 5, all being a derivative from the conical arrow. In this case, however, instead of the blackwood head being circular, as in No. 5, it is square in section, a series of forty-one nicks extend over a length of 54.5 cm., the total length being 157 cm. Waxed shell and parakeet feathers complete the decoration at the base of the head.

No. 7 from the same district, is a barbed arrow 138 cm. long. The point, which is 69.5 cm. in length, is tipped with a discolored cassowary bone, and bound to a reed shaft with palm-leaf. The predominant design is the concentric diamond, which design also occurs in No. 9.

No. 8 is from the same locality as No. 7. This unusual arrow head is particularly beautiful in design. It consists of barbs, pointing in both directions, filled in with white and dull red coloring, and extending for a length of 23 cm. along the shaft. After the main row of barbs is the design (No. 9) of concentric circles and ridges, these being a conventionalisation of the curled lizard or crocodile tail, and the dorsal scales respectively. The whole design is heightened in lime coloring on the blackwood background. Length of point (No. 8 and continued in 9), 51 cm.; overall, 146 cm.

No. 10, also from the same district, is of unusual form; the point, instead of being straight, follows a meandering curve.

No. 11 shows continuation of the head and the ribbed design; small white shells being set in wax. At the end of the binding a length of rattan is left free. During the process of wrapping, the natives sing an incantation song, which passes the charm into the arrow. (Edge-Partington, p. 158). Length of point, 71 cm.; total length, 148 cm.

No. 12, from the Wapi district, North Coast, is of bamboo, the head barbed and carved in the round, the design being incised on the light color of the natural cane. Length of point, 41 cm.;; total length, 134 cm.

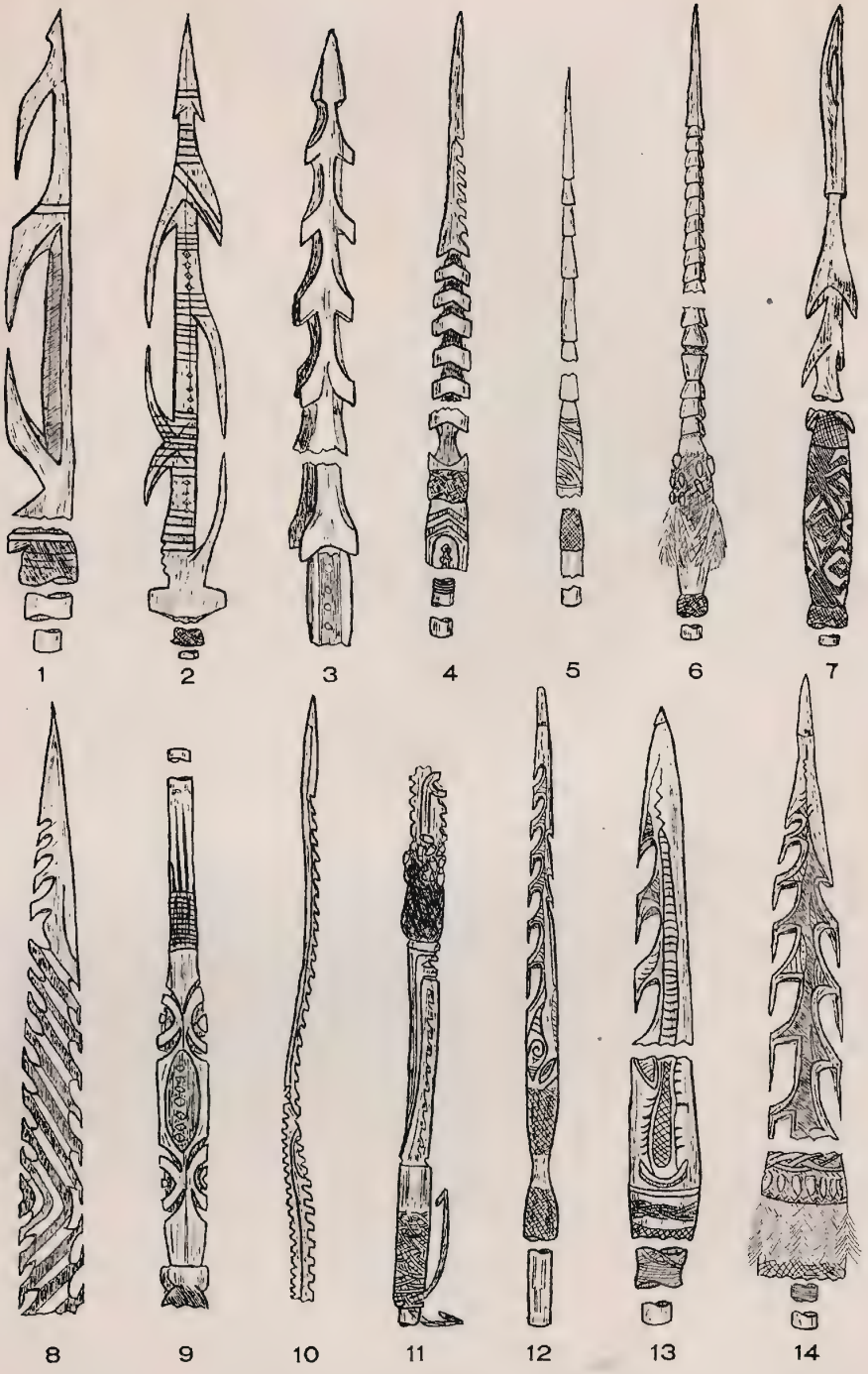
No. 13 is a bamboo headed arrow from the same locality, with a single row of barbs bound to the shaft in the usual manner. The decoration of the head of possibly snake pattern, is in black. Point, 47 cm.; total length, 147 cm.

The snake design is common to many districts of New Guinea and Papua, and is distributed as far as the Torres Straits. In this area snake, lizard, and crocodile cults are in existence.

This snake decoration on arrow thirteen may have produced, when ultimately conventionalised and drawn in different positions, the concentric circle and spiral.

MacKenzie (1930, p. 150) tells of a legend from New Britain, Melanesia, that the creator of all things was a female snake-goddess. Again on pages 151 and 152, he mentions that in British New Guinea (Papua) a myth tells of a great flood which covered the land, and the people took flight to the summit of Tauaga, the highest mountain. The waters rose higher and higher, and when the summit was threatened, Raudalo, "the King of Snakes," who resided there, displayed his great power, "he put forth his forked tongue, and touched with the tip of it the angry waters," the flood retreated down the mountainside, over the plain country, until the seashore was reached, "and was stayed."

There are many Melanesian tales with the association of snakes.



Drawings of the arrows described in the text.

Top Row (from left to right) —1 and 3, Australian Spear Heads; 2, 4, 6, and 7, from North Coast, New Guinea; 5, from South Coast.

Bottom Row—8, 9, 10, 11, 12, 13, and 14, from North Coast of New Guinea.

(From originals in South Australian Museum.)

No. 14, from the same district, is of bamboo, barbed and decorated, the drawing on the convex face being in black. It is bound to the shaft with fourteen separate types of palm-leaf plaiting, while small white shells and red parakeet feathers are mounted in wax. This arrow is particularly artistic, both in design and color. There are horizontal nodel decorations on the reed shaft. Length of point, 62 cm.; total length, 147 cm.

These wide bamboo pointed arrows are used for shooting pigs. Haddon (Decorative Art, 1894, p. 48) was told that they were also aimed at the abdomen of the enemy in order to rip it open.

The above examples are picked specimens of arrows and spears from the collection of the South Australian Museum.

It is fortunate that there are numbers of arrows in this collection which can be compared with the spears of Australia, both in barb, structure, and decoration.

Much beauty is lost in the reproduction of the arrows, both as regards length, coloring, and general design. But what are illustrated convey some idea of the symmetrical workmanship and skilful manipulation of wood and bamboo in both spear and arrow, which are carved and incised with primitive implements and painted with simple pigments. Above all, the weapons illustrated show the artistic ability of the native craftsmen.

The map shows the position of districts and localities mentioned in this short paper.

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Mountford, C. P., 1937 B, Aboriginal Crayon Drawings. Rec. of S.A. Mus. 6 (1), 22.

Australian and Tasmanian Stone Implements of Unknown Use

By C. P. Mountford, Acting Ethnologist, South Australian Museum.

This short paper describes eight examples of a hitherto unrecorded type of stone implement, five from the Northern Flinders Ranges of South Australia, one unlocalised, one from Muston, Kangaroo Island, and one from Sandy Cape, Tasmania. The South Australian examples, A, C, E, F, G, H, were obtained by that indefatigable collector, Mr. H. M. Cooper, whose material is of inestimable value to all interested in the Stone Culture of the South Australian aborigines. The remainder, B and D, are from the collections of the late Prof. W. Howchin and of the late Dr. R. H. Pulleine, both equally enthusiastic students of the South Australian and Tasmanian artifacts respectively.

Description.

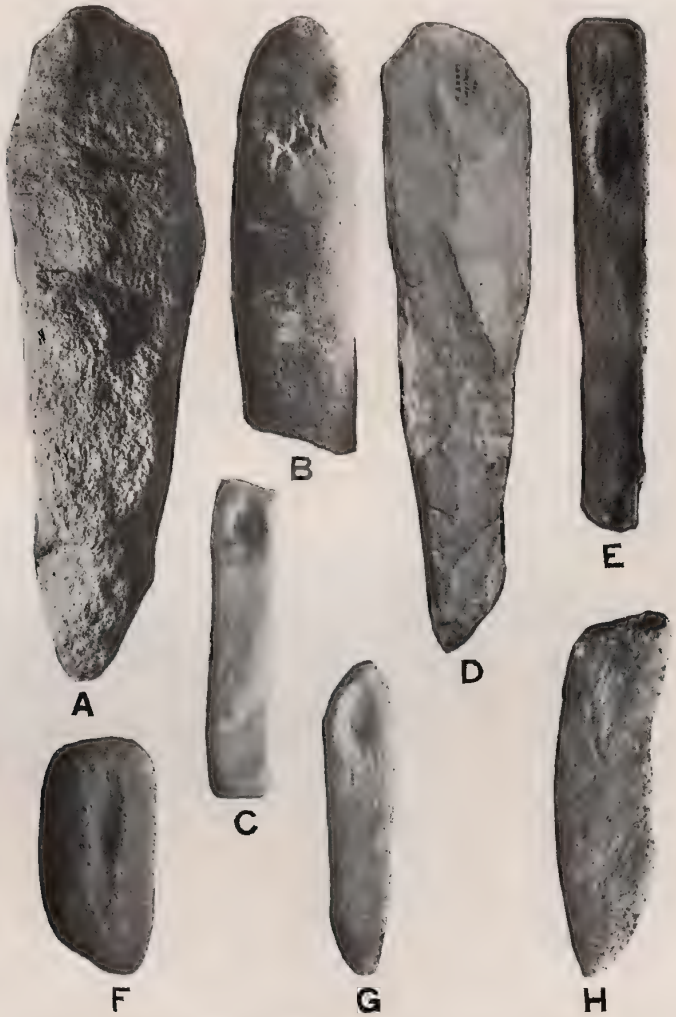
The South Australian mainland examples are all similar in shape. Water worn pebbles have been utilised for these tools, and no chipping or flaking of any sort has been employed in their manufacture. With the exception of F, the wear is restricted to one end only, the location of the abrasions and the general shape of the tool suggesting that the stone was held in the hand of the manipulator by one end, and blows struck with the other. Each implement reveals like usage on the reverse side to a greater or lesser degree, the centres of the abrasions varying from one to three inches from the extremities of the stones.

The examples from Tasmania and Kangaroo Island, on the other hand, although of a somewhat similar form to those on the mainland show no signs of wear on the flat surface, and except for the fact that A is the more eroded, are remarkably like each other. A, when collected on an aboriginal camp

site at Muston, Kangaroo Island, was lying within a few inches of a chipped pebble implement, similar to those described by Tindale, 1937, p. 49. The implement had been manufactured from a fine grained schist, and was 22 cm. long, 7 cm. thick, and flat on one side.

B was made from a waterworn pebble, somewhat oval in section. This specimen, which unfortunately is not localised, was 14 cm. long and 4 cm. in width. The abrasions were confined to one end, but unlike C, E, F, G, H, showed similar marks on the edges as well as the faces of the implement. The general resemblance of this implement to those collected by Mr. Cooper, and the fact that the late Professor Howchin travelled extensively over the upper north of South Australia would suggest that this stone was collected from that area.

C was collected at Morowie Waters, at the eastern entrance to Mt. Chambers Gorge in



AUSTRALIAN STONE IMPLEMENTS OF UNKNOWN USE.

A, Muston, Kangaroo Island. B, Unlocalised. C, Morowie Waters, Northern Flinders. D, Sandy Cape, Tasmania. E. F, G, and H, Brachina, South Australia.

the Northern Flinders. It is 20 cm. long, deeply pitted on both sides, that on the reverse being .7 cm. deep. Although this stone was square, these were the only sides used.

D, from Sandy Cape, Tasmania, had been manufactured from a fragment of grey slate. No signs of abrasion was visible on this specimen. Its resemblance to the Kangaroo Island artifact has already been noted.

E, from Brachina, is 31 cm. long and somewhat resembles the Tasmanian and Kangaroo Island examples in shape, except that it was deeply abraded on one end.

F, from the same locality, was 14 cm. long and deeply pitted on both sides, and except for the fact that there were no abraded edges might have been mistaken for a hammer stone.

G, collected on the same camp-site as F, was deeply abraded on both sides but not on the edges. This specimen was 19 cm. long.

H, also from Brachina, is a somewhat oval waterworn pebble, 19 cm. long, and lightly pitted on both sides.

Discussion.

All the implements under discussion in this paper are rare and of unusual form. Mr. Cooper has examined over two hundred and fifty camp-sites in Kangaroo Island and North and Central South Australia, and all the examples found by him are figured in this paper. Little is known about the Tasmanian artifact, but all the South Australian examples were found in association of either the "horsehoof" core, or the chipped pebble type of implement, and were in all cases partly buried in the surrounding soil. Tindale (1937) has already drawn attention to the close resemblance between the Tasmanian, South Australian, and Malayan examples of "horsehoof" core and chipped pebble implements.

The deep pitting that characterises the hammer stones of the Australian aborigine, caused no doubt by the striking of harder material, is not evident in C, E, and G. The appearance of the wear on these particular implements would indicate that softer substance, such as wood or bone, had been struck, and the deep and localised pit suggest that such a tool was of a small diameter.

Summary.

This paper describes eight aboriginal stone implements of unusual form, one from Tasmania, the remainder from South Australia. The possible use of the implements and the resemblance between certain of the South Australian and the Tasmanian forms is noted.

Literature.

Tindale, N.B. (1937); Records of S. Aust. Museum, Vol. IV, No. 1, p. 41-59.

Report on a Botanical Excursion to Kapunda, 24/9/38

Twelve members, under the leadership of Mr. E. H. Ising, made the trip by rail car. Most of the party alighted at the crossing near the River Light, and walked from the river into the town. A total of 57 native plants was collected: these were found in property from which sheep and cattle had been excluded. It is to be regretted that reserves have not been made in this part of the State, and in many others as well, so that the native life could have been preserved intact for future generations to see and study.

The flora in this locality seems to be partly made up of species that grow in the higher parts of the Mt. Lofty Range, and those of the plains north from Adelaide. The most interesting finds were as follows: *Bulbine bulbosa*, a yellow star flower of the lily family; *Swainsona lessertifolia*, a purple pea flower; *Minuria leptophylla*, a daisy with white or pink flowers; *Velleia paradoxa*, a fine yellow flower allied to *Goodenia pusilliflora*, which was also flowering; a third yellow daisy was *Leptorrhynchus* (2 species), which helped to make the ground gay; *Acacia obliqua*, a small wattle; and *Cynoglossum suaveolens*, a small plant with small flowers, which are very strongly and sweetly scented.

This appears to have been the first trip to Kapunda by our section, and the members who went will not easily forget the kind hospitality of the Misses Murray, who provided a delicious and welcome afternoon tea, for which they were suitably thanked by Professor J. B. Cleland and Mr. W. D. Wade.

E. H. ISING.

A Native Plant Allied to the English Broom-rape

Orobanche australiana, F. v. M.

By ERNEST H. ISING.

The members of the Broom-rape family *(Orobanchaceae)* are usually parasitical on the roots of other plants, and they are found in both hemispheres, being abundant in the Northern Hemisphere in the old world, less so in North America, and very few of the European species have also appeared in the Southern Hemisphere.

There appears to be only one endemic Australian species, which is found in the States of Victoria, West and South Australia. Two species are recorded for our State (Black's Flora, 1929, p. 156). One is an introduced species, and is found at Brighton, the other is a native and is found around our coast on the sandhills.

A party of members visited the sandhills at Henley Beach South on October 29, 1938, and were interested to see specimens of our native species, *Orobanche australiana*, in flower. The sandhills are still covered with their original vegetation, and some of the chief plants are a white daisy bush (*Olearia axillaris*), *Scaevola crassifolia*, a sticky spreading shrub, *Pimelea sp.*, *Alyxia buxifolia*, a hairy grass with long runners growing chiefly on the sea-face of the dunes (*Spinifex inerme*), *Rhagodia*, the sword rush (*Lepidosperma gladiatum*), *Pelargonium*, old man's beard (*Clematis microphylla*), a densely intricate whitish-grey bush (*Calocephalus Brownii*), the sand dune wattle (*Acacia longifolia* var. *Sophorae*), a water bush (*Adriana Klotzschii*), sea rocket (*Cakile maritima*), and a coastal saltbush (*Atriplex cinereum*). *Orobanche australiana* was growing on a yellow daisy (*Senecio lautus*) as a root parasite, and a number of plants were seen on the occasion of the above visit. The flowering period was almost over, but the purple corollas could be seen on some of the plants. Four specimens were carefully dug up, and in each case the plant was found to be attached to the root of a plant of *Senecio lautus*. This host plant is not confined to this habitat, but is widely spread in our State, and I have only found the two plants in association on the sand dunes along St. Vincent's Gulf. This parasite has been recorded by Black (l. c.) for our State as growing usually in sandy soil along the coast near Adelaide, and on Yorke and Eyre Peninsulas, and from creeks in the neighborhood of Lake Torrens. The plants are annuals, and produce twenty to forty flowers on each plant, and each flower is capable of producing numerous tiny seeds. It would appear that usually very few seeds germinate as the plants are rather rare. The conditions necessary for the seeds to germinate are difficult to ascertain, and one can only surmise that the seeds germinate as free plants, and their roots eventually come into contact with their host in their early life. On the other hand one is led to speculate whether the *Orobanche* seeds establish contact with the roots of a host plant before they develop, and if not, how long the seedling can live in its free state.

In this connection there is a definite statement in Strasburger's Text Book of Botany (1921), p. 121, as follows: "The seeds of *Orobanche*, a parasite, only germinate when in contact with the roots of the host plant; only its haustoria penetrate the roots and its light-yellow, reddish-brown, or amethyst-colored flower shoot appears above the surface of the ground. *Orobanche*, like *Cuscuta*, contains a small amount of chlorophyll. Both are dreaded pests: they inflict serious damage upon cultivated plants, and are difficult to exterminate."

The plants obtained from Henley Beach had some small roots which were free in the soil, while the base, swollen to about twice the size of the stem, was attached to a long slender root of the host plant, *Senecio lautus*. This will be seen in the accompanying illustration, which shows both plants and the connecting root. It will be observed that the root from the host, which is attached to the parasite, is much longer than any of the other host plant roots. The connecting root in the above illustration is 12 inches long, while another specimen collected had a similar root 17 inches long.

The family OROBANCHACEAE comprises 11 genera and about 150 species throughout the world. In the genus *Orobanche* there are about 90 species with one occurring in Australia. The name *Orobanche* comes from Gr.

orobos, pulse, and *anchein,* to strangle, owing to its supposed power of destroying the plant on which it grows. Sowerby's English Botany, Vol. VI (1880), p. 191, says that these plants are glandular-hairy fleshy herbs without green leaves, parasitical on the roots of various dicotyledonous plants; the base of the stem (which is often swollen) directly attached to the roots of the plants on which it is parasitic. There are ten species in England, and they are parasitical on various plants, both native and introduced. The plants are used as a remedy for diarrhoea, etc., and as a wash for ulcers. Truly parasitical, and derive no sustenance from the soil. Each species has its favorite plant on which to subsist and ultimately to kill.

It is not likely that this plant will become a pest in our State, as it appears to be almost solely restricted to the sand dunes along our coast, and the plants are actually rare in their occurrence. I have no evidence of the parasite being able to kill its host, which is always a much larger plant, and is a perennial, whereas the *Orobanche* is an annual. The parasite may obtain some nourishment from the soil by its small free roots, which are also shown in an illustration in Engler's Pflanzenfamilien, Teil LV, Abteil 3 B (1897), p. 123, Fig. 56.

Root parasite *(Orobanche australiana)*, on left, attached to native host plant *(Senecio lautus)*, on right. The connecting root is 12 inches in length.

(Photo. B. C. Cotton)

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